Exploring Trust as a Function in Common Resource Management

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(…)Under such conditions, the natural sciences can recognize that some problems are not technically soluble and relegate them to the nether land of politics, while the social sciences recognize that some problems have no current political solutions and then postpone a search for solutions while they all wait for new technologies with which to attack the problem. Both sciences can thus avoid responsibility and protect their respective myths of competence and relevance (…)

(Beryl L. Crowe 1969:1103)

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Abstract

When people try to manage limited resources together, why do they sometimes fail and sometimes succeed? Since the time of Aristotle, scholars and laymen alike have twisted their minds around the subject. With the frightening prospect of severe future climate change, a growing world population, and steadily increased stress on global resources, the significance of securing "our common future" only grows by the day.

In the remote islands of the Sunderban delta of West Bengal, India, 4.5 million people live and work without access to the national electricity grid. The inhabitants use sources of fuel like kerosene, wood and cow dung. As customers of off-grid solar PV mini-grids, installed by the state and other implementing agencies, some now have access to electricity. Between 1996 and 2011, 18 solar mini-grids were installed on the islands, supplying each customer with 70-200 W daily**.**

The power plants have limited capacity, and tariffs are based on flat rates. Customers are not allowed to consume more electricity than the agreed upon limit, but in most cases, no current meters or circuit breakers have been installed. The high level of compliance throughout the past decade has surprised both scholars and practitioners, who have characterized the supply systems as a "rural electrification story."

However, the situation has gradually changed. Customers have stopped paying electricity fees, started consuming more electricity than allowed, and stretched illegal cables over to their neighbors. At the same time, the capacity of the mini-grids has declined. This gives rise to the question: why did the customers comply with the agreements for a decade, and then stop complying, while at the same time knowing that their actions would negatively affect supply?

A multiple case study from three Sunderban Islands was conducted to shed light on this question. Thirty-four interviews were conducted during fieldwork in August 2011, with people involved at all levels of the supply chain – customers, operators, monitors, funders and implementing agencies. By employing data from fieldwork and earlier research on the subject, variations in compliance between contexts and in time are explored.

Questions like the ones posed in this thesis are extensively discussed within the field of common resource management. To answer the research question, the thesis starts with common resource literature and aims to take an explorative approach to the

subject. *Trust* is identified as a useful concept to trace the variables affecting the variations in levels of compliance. By employing trust as an analytic concept, the thesis finds that compliance has been influenced by a combination of factors, with different combinations of variables leading to different outcomes between contexts and in time.

Levels of compliance have varied with capacity of the technology, the type of institutional set-up, degree of and type of enforcement, customers' knowledge and expectations of the technology, and expectations of other customers' and institutions' actions. In addition, the situation found in the Sunderban Islands has been shaped by global developments in recent decades, affecting the customers' general hopes and dreams for their lives.

Acknowledgements

The moments I hold most dear from the work with this thesis are from the Sunderbans, these vulnerably situated islands in the Bay of Bengal, inhabited by courageous people I have come to admire. On ferry rides on tidal waterways, in remote villages and homes made of mud or brick, they presented me – the stranger – with warm, curious smiles and generously shared their thoughts, dreams and opinions on life with me. This thesis is dedicated to the Sunderbani people, who probably never will lay eyes on this thesis, but whose strength and brave hearts should inspire us all.

Krishnapada Sasmal, my interpreter in West Bengal, this fieldwork would never have been possible without you. Thank you for your excellent interpretation, for everything you taught me about India, and sharing your big heart for others.

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For me, sociology is a way to see the world more clearly, and to make it more understandable. Important insights like these should not be left to isolation in the world of science. The sociologist should strive to make complex social processes more accessible and understandable, especially to the layman. I am therefore grateful to Tiril Walseng for reading an early draft of the manuscript through "the eyes of a non-professional", and to Allan Ishac for excellent proofreading.

Conducting fieldwork in West Bengal truly made me count my blessings. Therefore, I want to thank my family, who has always accepted, and often encouraged my choices. Also thanks to my "extended family" of Anne, Cathrine and Lisbeth, because everyday life would not been the same without you. And my gratitude goes out to fellow sociology students and students of SUM's reading room – for coffee breaks, good conversations and all the other things that matter. Of course, you know who you are. Last, but not least – my sincere thanks to those who have expressed faith in my thesis, saying they look forward to read it. Writing is always more fun with an audience.

Oslo, June 25th,

Vilde Blix Huseby

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Abbreviations

AC	Alternate Current
BC	Beneficiary Committee
CFL	Compact Fluorescent Lamp
DC	Direct Current
GP	Gram Panchayats
INR	Indian Rupees
kWh	kilowatthour (unit of energy produced or consumed over a given period of time
PV	Photo Voltaic
SHS	Solar Home Systems
W	Watt (Unit of power that measures the rate of energy conversion or transfer that is produced or consumed momentarily)
WBREDA	West Bengal Renewable Energy Development Agency

Glossary

Auto rickshaw:	A three-wheeled, motorized cabin cycle used for transport
Bãdh:	Embankments to protect the islands
Beneficiary Committees:	Customer Committees on Sagar and Moushuni Island
Board of Directors:	Customer Committee on Satjelia Island
Bhut-bhutis:	Country motor boats, used as ferries between islands
Calcutta/ Kolkata:	The anglicized *Calcutta* is used in reference to incidents predating 2001, and the Bengali word *Kolkata* when referring to the present.
Cycle van:	A human powered cabin cycle, also called a cycle rickshaw
Gram Panchayat:	Local self-governments
Mini-grids:	An electricity distribution network, typically operating below 11kV, providing electricity to a localized community and deriving electricity from a solar PV power plant with its own storage (batteries) facilities
Mouzas:	Larger villages or towns or clusters of towns and villages
Off-grid:	Refer to an electricity supply system not connected to the main electricity transmission grid. Typically stand alone systems; like solar home systems, or mini-grids. Such can be based on any form of electricity.
Panchayaty Rai:	Formal and informal governance structures, known as local self-governments
Zila parishads/ zillas:	Political districts

1 Introduction

"Tell Norway; we need solar home systems, not mini-grids!"

We were sitting in a mud house in the Western part of Sunderbans, in the home of Bhumit, about to end an hour-long interview. Colorful mats had been uncurled for me and my interpreter so we could sit comfortably on the ground, and Bhumit's wife had prepared the traditional tea with milk and sugar for us before we left. During the interview, we had circled around Bhumit's experiences as a customer of his village's solar power plant. While now chitchatting about the midnight sun and how far away Norway was, he suddenly felt the need to return to this issue, by bursting out with the above request for me.

1.1 Solar mini-grids in Sunderbans

Bhumit was a man in his 40's, living and working in one of the many islands in the Sunderban delta of West Bengal, India. His island was too remotely located to connect to the national electricity grid, but an off-grid solar mini-grid had been set up in Bhumit's village to provide him and other villagers with electrical power. The mini-grid was a small power plant, providing him and other villagers with a few hours of electricity daily – derived from solar photovoltaic panels and stored in battery banks. The electrical power was supplied to the customers through distribution lines from the power plant to the households. When the mini-grid was installed, it was the first time in his life Bhumit had access to electrical power, and now more than ten years had passed since then. Access to electrical use had led to several positive effects in his village, like increased mobility at night and economic growth.

People visiting from the outside had been stunned by how successful the organization of power supply was. In comparison to similar projects, it was quite uniquely organized. The system was based on community management, and current metering systems were absent. Tariffs were based on flat rates, and everyone was to use the same amount of electricity, following a collectively agreed upon amount. Because of

the lack of metering systems, electricity theft would have been easy, but surprisingly to outsiders, everyone followed the rules. The management of the solar mini-grids was even highlighted in several studies as success cases of good governance and community participation (Gulati and Rao 2007:129, Shrank 2007:7-8, Chakrabarti and Chakrabarti 2002:38-40).

All was well throughout a decade, and then things gradually started to change. When or how it all started was not certain, but by the time I sat on Bhumit's floor, dissatisfaction had been evident for quite some time. Electricity theft and overuse had become widespread and the technical capacity of the plant had now gradually declined. It was therefore a man who was very dissatisfied with the situation that I was interviewing, and largely because of this, Bhumit showed some persistence in his request for me to tell Norway about the advantages of solar home systems. Six years earlier, Bhumit had been able to afford his own solar home system – a system supplying electrical power for individual buildings. He wanted to emphasize that the solar home system had remained perfectly free of problems all these years. In comparison, he emphasized, supply from the mini-grid was characterized by shortages, halts in operation, and steadily decreasing hours of supply.

Throughout my stay in the Sunderbans, and over the months that followed, I found that Bhumit's words were replayed over and over again in my mind. They made me deeply concerned. Bhumit's words echoed the words of so many other customers in the Western Sunderbans. It was evident that these people were very dissatisfied with the situation they were in. Electrical power was described as "the most important thing in their life," and now customers were angry and frustrated. However, it was hard to place blame, causing them to direct it towards various targets. People blamed all parts of the supply chain, from the technology and other customers to state agencies, politicians and suppliers of technical equipment. They were unable to decide on who was responsible, and unable to follow the rules. Bhumit described it like this: "Everybody cheats the system. It is a total system failure."

1.2 The future prospect of solar mini-grids

The customers' stories made me, the researcher, feel terribly pessimistic about the prospects for mini-grids. Solar mini-grids had been proposed as a useful solution for

both developmental and environmental problems (Chaurey et al. 2010:2274, Chakrabarti and Chakrabarti 2002:37). Globally, problems with both energy poverty and emissions from polluting energy sources were growing (Armorali and Balzani 2007:52-53, Asif and Muneer 2007:1390-1395). Part of the reason for doing research on solar mini-grids was a hope that solar mini-grids could be one of our pollution-free, renewable technologies in the future.

However, the customers' accounts made me doubt whether the mini-grids really were such a good solution. Their experiences made them call for more control, and many saw implementation of current meters for measuring electrical power use as the only way they could do this. As Bhumit said: "With no meter, no punishments." The problem was that metering technology had originally not been installed because it was too costly and complicated to implement due to a lack of infrastructure and the low income from electricity fees (Ulsrud et al. in progress). There were no signs that there would be financial resources to implement these in the future.

Of course, solar home systems could have been favored over the mini-grids. The problem here was that there were problems related to this type of technology as well (Nieuwenhout et al. 2001:466-468). Installation of large solar home system schemes in villages had proved to fail because people did not have enough knowledge of how to operate such individual electricity systems. They also did not have money to replace the batteries, leaving the solar home systems to become waste polluters.

In addition, solar mini-grids had certain advantages, like facilitating the set-up of commercial organization and allowing the use of more readily available AC appliances (alternate current) instead of the DC (direct current) appliances normally required for solar home systems (Ulsrud et al. 2011:3). I was therefore disappointed when I discovered that solar mini-grids did not appear as the promising future technology that I had hoped.

My pessimism remained until I traveled to another remotely located island, this time in the Eastern part of Sunderbans. A solar mini-grid was installed here also, in a small village far away from the mainland. Also here, a mix of Hindus and Muslims lived together in small villages, most of them growing betel leaves. In the same way as the Western Sunderbans, the island was too remotely located for the national electricity grid to reach it. Villagers had to spend hours traveling over tidal waterways and largely devastated brick roads to reach the nearest rail and road connections. Also here, it was

the first time these villagers had gained access to electricity, except for a few customers who could afford solar home systems. But here, the similarities between the cases stopped. Something was different here. Customers spoke of their mini-grid with great happiness and pride, and here, everyone cooperated, everyone followed the rules and no one was blaming the other for cheating the system.

1.3 Variations in compliance

How could this be? My curiosity was awakened. The experiences from the Eastern side could imply that the problems with the solar mini-grids on the Western side were not caused by the technology of the solar mini-grid. The people on the Western and the Eastern sides of Sunderbans all lived in a climatically vulnerable location, shared the same culture, the same values and standard of living, and all had electricity supplied from solar mini-grids. Still, the customers on the Western and Eastern sides had remarkably different perceptions of their mini-grids, the way they looked at each other, and the extent of compliance to the rules of the electricity supply chain.

How could these differences be explained? The case on the Eastern side also further triggered thoughts regarding the Western side. What were the customers´ reasons for first sticking to the rules, but then starting to steal electricity and stop paying their bills? It was the same type of management system that had been in place since the start, with absence of control mechanisms like metering systems all along.

However, one common trait could be identified: these cases were all based on collective management, in the sense that customers were sharing and governing the limited supply from electricity together. In the academic literature, such cases are often simply referred to as “commons”, common resources or common property (Burke 2001:453, Danda 2011:98). The literature on the commons is extensive, with contributions from a wide range of disciplines. The reason why literature is so extensive is very simple –the Sunderban cases are not unique. They are only a few examples of a number of cases throughout the world where people share limited resources amongst themselves. Such resources can be everything from natural resources like land plots and water, or human made resources and services (Ostrom et al. 1999:278). The literature on common resources is filled with the same type of problems as I was concerned about with the Sunderban cases: when people need to share and manage a limited resource,

why are they sometimes able to agree on how to manage the resource together and sometimes not?

The path to understand these cases will start in the literature on common resources management. The theories will be applied to the cases from the Western and Eastern Sunderbans to analyze the variations found in the Sunderban cases. The data material that will be employed for the analysis is 34 interviews conducted in six villages in the Sunderbans in August 2011. It consists of interviews with customers, operators, local monitors and implementing agencies of the solar mini-grids. The analysis also draws on earlier research on the solar mini-grids in Sunderbans, like Ulsrud et al. (in progress), Ulsrud et al. (2011), Winther (2012), Winther (forthcoming), Chakrabarti and Chakrabarti (2002), Vognild (2011), Moharil and Kulkarni (2007), Danda (2007) and Shrank (2008), to supplement the data.

The thesis aims to explain why the customers were either complying or non-complying between different contexts and within time. The research questions are therefore posed to account for the customers´ reasons for compliance and non-compliance and how these have been affected by characteristics with the technology, the institutions of the supply chains, the way they have been organized, and various changes that might have affected either the customers´ reasons or the institutions they were associated with over time. Three research questions are posed:

1) *What were the customers' reasons for either complying or not complying with the collective agreement of the solar mini-grids?*

2) *How did institutional, organizational and technical characteristics influence peoples' reasons for complying with or not complying with the rules?*

3) *How had social and technical processes shaped the customers reasons for complying or not complying over time?*

1.4 Structure

The next chapter will describe the climatic, cultural and political characteristics of Sunderbans, and the practical rationale for studying these cases. Chapter three presents common resource theories, discusses its strength and weaknesses and the theoretical

rationale for approaching the subject. The discussion leads to chapter four, which discusses concepts and theories that can improve the ability of common resource theory to understand cases such as the Sunderbans. In chapter five, the choice of method and research design will be accounted for and issues of reliability and validity will be discussed. Chapter six describes the organization of the mini-grids at the islands located on the Western side of Sunderbans, and analyzes how the situation has gone from compliance to non-compliance. The seventh chapter describes the case situated on the Eastern side and discusses how institutional, technical and organizational factors can explain why the customers are complying in this case. In the eight chapter, the experiences from the cases will be compared and the theories' strengths and weaknesses in understanding these cases will be discussed. The last chapter will revisit the questions posed in the introduction, and a summary of the results will be presented.

2 “Solarizing Sunderbans”

Until you behold it for yourself, it is almost impossible to believe that here, interposed between the sea and the plains of Bengal, lays an immense archipelago of islands. But that is what it is: an archipelago, stretching for almost three hundred kilometers, from the Hooghly River in West Bengal to the shores of the Meghna in Bangladesh.

(Ghosh 2005:6-7)

2.1 The Tide Country

The etymology of *Sunderbans* means “the beautiful forest,” but to the inhabitants this land is known as *dhatir desh* – “the tide country.”This is a land half-submerged at high tide, and boundaries between land and water are always mutating. The Sunderban islands numbers in thousands, and are reshaped by the currents almost daily, with salt and fresh water merging in tidal waterways crisscrossing between islands. It is a delta of watery labyrinths, filled with thousands of acres of salt-tolerant mangrove forests and a wide range of fauna. Parts of Sunderbans were declared Tiger Reserve in 1973, parts of it declared National Park in 1984, followed by a listing on the UNESCO world heritage site from 1987. Numerous species of birds, spotted deer, crocodiles, snakes and Bengal tigers inhabit the islands – along with 4.5 million people. Bhumit and the rest of the people clinging on to these islands face a plethora of daily challenges. The inhabitants have to keep wild and dangerous animals away, cultivate inhospitable mud land and face unpredictable events like dramatic weather conditions and natural disasters such as flooding and cyclones (Bera and Sahay 2010:77, Ghosh 2005:6-7, Danda 2007:27, 38, Ulsrud et al. in progress).

To understand the choices the people on Sunderbans make, like complying or not complying to the rules of electricity supply, we need to understand the characteristics of the conditions they live in. Historically, the Sunderbans has been a frontier, in the sense of a border between the settled and the unsettled, the “civilized” and the “wilderness.” The 355 km wide delta the islands are located in, divided between West Bengal and Bangladesh, comprises the largest mangrove forest in the world. From the 13th century, the forested land was largely transformed for cultivation by Muslim Indo-Turkish

sultans, continued by Mughal rule inthe 16th and 18th century, until the British control of the land from 1764. While the land remained under judicial control, the forest, watercourses and sea remained as open-access resources – everyone could go into the woods and cut as much timber as he desired (Danda 2007:28-30). Even today, many inhabitants venture into the most remotely located islands to collect forest resources such as timber and honey in order to diversify and increase meager incomes.

Weather is tropical, with climate warm and humid. The population is spread across 48 islands, and population density is high – with 671 inhabitants per km^2 (Danda 2007:28, 81). The Sunderbans' geographical location at the mouth of the Bay of Bengal exposes it to violent climatic conditions, aggravated by the impacts of climate change. Some estimates predict that half a million Sunderbani people will be rendered homeless by 2020 due to a predicted sea level rise. Without earthen embankments (*bãdhs)* to protect the islands from damaging floods, human habitation would have been impossible. In addition to threats of natural disasters, developmental challenges are immense. These include improvements of roads, health care and education, better access to potable water and electrification (Danda 2007:40-42).

The economy on the islands is mainly based on agriculture and supplemented by income from fishing or the collection of forest resources. Farmers grow crops like paddy, chili, betel leaves and coconuts and 85 percent depend on one single crop (Ulsrud et al. in progress). Despite land reforms, 56 percent of the population is landless, as the political focus has been on security to till the land rather than on ownership. The agricultural land is victim to frequent flooding, and the poor road and rail connectivity to Kolkata markets makes it difficult for the farmers to reap the benefits in monetary terms (Danda 2007:27-42). Poverty is widespread; the population below poverty line for the Indian part of the Sunderbans is said to comprise around 30-35 percent of the population (Ulsrud et al. in progress).

2.2 Religion and politics

The political history of both India and West Bengal is worth noting. India is currently the largest constitutional democracy in the world. Following independence from British rule, India has been an anomaly in the class of postcolonial countries, because of its success with democratic institution building. This success has in large degree been

attributed to the collective wisdom of its national leaders, like Mahatma Gandhi and Jawaharlal Nehru, who managed to reconcile the great religious, regional and ethnic differences of the country (Ganguly and Devotta 2003:73-74)**.** However, from the mid1960's, growing governance problems arose. Politicians increasingly began to rely on "populist waves" to secure electoral majorities and state leaders increasingly demonstrated disregard for constitutional and legal constraints. From the early 1970s, previous commitments to the ethics and customs of parliamentary democracy declined, making graft, corruption and populist politics widespread throughout India (Ganguly and Devotta 2003:73-77).

The state of West Bengal is one of a total of twenty-eight state governments in India, and home to the longest lasting democratically elected communist coalition in the world. The left front coalition, with the Communist Party of Indian Marxists (CPM) taking the lead, ruled the state for 34 years, from 1977 until May 2011, when the All India Trinamool Congress (TMC) won elections. Below the state government is a range of formal and informal governance structures, simply known as "local self-government." The federal constitution directs all levels of government to contribute to "democratic decentralization," by reviving or creating *panchayati rai*-institutions and enabling them to function as units of self-government (Ganguly and DeVotta 2003:67-69). The state of West Bengal is unique in this connection: West Bengal was the first to ensure peoples' participation at the grass root level by conducting party based *panchayat* elections from 1978. In addition, it is one of several states in India to have established a three-tier structure of *panchayats*, taking various active steps to use the *Panchayati Ray Institutions* (PRI) as instruments to promote rural development (Islam and Sangita, 2003:3-5).

West Bengal is divided into 19 districts (*zillas*), where the Sunderbans fall under the North and South 24-Parganas district. Districts are divided into several *blocks* that again are divided into *mouzas* – larger villages and towns or clusters of such –and controlled by *Gram Panchayats*, the last level of elected self-government (Danda 2007:36, Ulsrud et al. in progress). The Sunderbans' history of self-governance is unique. It is said that the endeavors made on this land that inspired Mahatma Gandhi's rural cooperatives for a casteless society – started with a wealthy Scotsman named Sir Daniel Hamilton. He purchased 10,000 acres of land in the Sunderbans in 1903, with the dream of creating a utopian society. India's first cooperatives were formed here, in a classless,

self-governed society with its own central bank and currency, resolving all disputes in elected village councils. Immigrants were invited to come from all over India, asked to leave behind their caste and creed and consider everyone else as an equal. Hamilton's communitarian society was well developed – it was even said to been wired for electrical power before this new energy source reached Calcutta. Following Hamilton's death, his dream fell apart, yet his vision partly lives on in a trust that runs schools and livelihood programs for people on the islands (Ghosh 2006, Mazumbdar 2009, Dasgupta 2004).

Hamilton's project has shaped the composition of the population of today. It still consists mainly of immigrants from neighboring areas, who originally came to seek new opportunities or escape oppression in their places of origin. As a result, caste and religious problems are not as widespread as in mainland villages (Danda 2007:38, 100). For instance, in the Eastern part of the Sunderbans, close to the Bangladesh border, we can even find the peculiar practice of Hindus and Muslims believing in the same goddess. Here, people worship the secular goddess Bonbibi, who protects those entering the Sunderban forests for livelihood from the Tiger (Bera and Vijoy 2010: 107). It is said that the role of Bonbibi is reflected in the very essence of life in the Eastern area of Sunderbans, and that the influence of Bonbibi is probably greater than general religious affiliations (Bera and Vijoy 2010: xi).

2.3 Rural energy poverty

Daily challenges on the islands are many, and one of them is lack of access to good energy sources. Today, diesel is the predominant commercial fuel in the islands of Sunderbans, and a range of fuels are used in the domestic sector – which encompasses around 90 percent of energy use on the islands. Types of fuels span from biomass-based fuels such as firewood, cow dung, rice husk and straw to LPG (liquefied petroleum gas) and kerosene (Chakrabarti and Chakrabarti 2002:33, Danda 2007:81-82). From a global perspective, the situation of the people of the Sunderbans is not unique. Close to one-fifth of the world's population, or about 1.4 billion people, currently lives under extreme poverty conditions (IFAD 2011). Energy access is linked to several dimensions of poverty. As a result, access to clean, affordable and appropriate energy sources and services is seen as one of the crucial factors in eliminating poverty, and has made *energy*

poverty an emerging term in several studies. The energy poor use "dirty fuels," such as wood and cow dung, which are low quality energy sources. Gathering these fuels is time consuming (offering low productivity and low income), and can cause health problems and potentially contribute to deforestation. Two-and-a-half billion people still depend on traditional fuel, making energy poverty a wide-reaching development problem (Norhona and Sundershan 2009:223-224).

India is today the world's sixth largest energy consumer, and its electrical power demand is likely to increase threefold by the year 2051 (Asif and Muneer 2007:1404). At the same time, the threat of global climate change makes it necessary for the growth in the energy sector not to lead to large increases in the country's green house gas emissions. The diverse energy challenges of depletion of fossil fuel reserves, global warming, energy security concerns and rising energy costs (Asif and Muneer 2007:1397, Yergin 2006:69-82) have led these energy challenges to be described as "the most important issue of the 21st century" (Armaroli and Balzani 2007:52). During the last two decades, India has approached this problem with several government programs, using regulations, subsidies and innovative thinking on energy sources. The most important area of commitment has been to implement renewable energy sources like biomass, sun and wind power on a larger scale, acknowledged as one of the most important solutions to the world's growing energy challenges (Asif and Muneer 2007:1388,1396, Armaroli and Balzani 2007:56-62)

It has been especially important to provide access to *electricity* (Haanyika 2006:2977). Electricity is only one form of energy, but probably the most versatile, widely-used and consumer-friendly form. It can be generated from a wide variety of fuels – almost any form of energy in nature can be converted into electricity. Electrical power enables the storing of food and medicines, powers pumps to operate drinking water, facilitates the disposal of sewage, enables the mass transportation of goods and people, operates telecommunications networks, provides cooling in hot weather and heating in cold weather, and provides artificial light to extend natural daylight.

The entire infrastructure of modern communities depends on this form of energy (Gulati and Rao 2007:115), making access to electrical power essential to facilitate development. Of the world's inhabitants, 1.6 billion still lack access to electricity, and many of these people live in rural areas. Electrical power constitutes only 10-12 percent of total energy supply in rural areas of most developing countries today (Kumar

2009:1946). In 2007, only 44 percent of all rural Indian households were electrified (Modi 2007:16). The biggest energy challenge for India and other developing countries today is to secure access for people like the inhabitants of the Sunderbans – the rural poor. Only around 250,000 (5. 5%) of the inhabitants of the Sunderbans have access to electrical power (Ulsrud et al. in progress), and this lack of access to modern energy services limits the potential for income generation (Danda 2011:100).

The majority of India's energy poor live in areas without grid connection, and one of its biggest challenges is to secure rural electrification, as expansion of electrification of *rural* areas has developed particularly slowly. Although there has been several successful cases of electrification on a national scale (in countries as diverse as Costa Rica, Tunisia and China), electrification programs now face new challenges with higher costs when moving into more remote and less accessible terrains (Barnes 2011:260-263). It is unlikely that the part of the population that currently remains un-electrified will be reached by traditional grid-expansion methods (Barnes 2011:260-263). Decentralized energy sources are therefore seen as important to secure access to electrical power in remote areas (Chakrabarti and Chakrabarti 2002:37).

One of the measures undertaken by the state of West Bengal to address problems of energy poverty was to form the state agency WBREDA (West Bengal Renewable Energy Development Agency). WBREDA's mission is to aid the State Government, Panchayats, Municipal Bodies and NGOs in all matters of promotion of alternative energy sources. WBREDA's work has significantly increased the number of people with electricity access, and to the organization also has provided most of the electricity generating equipment for the people on Sunderbans (Ulsrud et al. in progress). WBREDA has contributed largely into making West Bengal one of the leading states in India with respect to utilizing renewable energy. Today, more than a hundred thousand families of West Bengal are supplied with electrical power from installations such as solar home systems, solar-mini-grids, biomass gasifiers, windmill systems and hybrids of these sources (WBREDA 2012).

2.4 Electrification of the Sunderbans

Solar photovoltaic power constitutes a significant share of WBREDA's electrification projects. While only 650 households had access to electricity before WBREDA started

pursuing their projects at the Sunderbans, by 2008 almost 1300 households were using electrical power provided directly by solar mini-grids alone (Shrank 2008:8). Every year, ten thousand new consumers start to use solar power in the state, and WBREDA and MNES (Ministry of Non-Conventional Energy Sources, India) are now formulating a scheme to set up two hundred solar PV plants in the Sunderbans (WBREDA 2012), as well as a large scale implementation of subsidized solar home systems to all inhabitants of targeted islands (WBREDA2, WWF). These solar mini-grids play an important role in the strategy for eradicating energy poverty in a pollution-free way. But whether it will work is still to be determined. Until now, several innovative off-grid electrification projects have been implemented all over the world, but a majority of them remains at the pilot demonstration stage and are yet to be fully institutionalized (Kumar et al 2009).

At the Sunderbans, the first solar PV plant with a mini-grid for distribution was installed in 1993, and in the following 15 years, a total number of 17 solar and hybrid mini-grids have been installed (Chakrabarti and Chakrabarti 2002:38, Ulsrud et al.2011:5). A typical power plant serves about 120 to 250 households grouped in a cluster (Gulati and Rao 2007:129), and is installed on land provided by the government. Solar panels are mounted on structures constructed of concrete and metal and charge a battery bank consisting of lead acid batteries during the daytime. At night, the electrical power is distributed to customers. The length of distribution lines are three to five kilometers, as a longer line would lead to a drop in voltage (Ulsrud et al. in progress), and such solar PV plants are capable of coping with unavailability of the sun for two days (Danda 2007:85).

Three Sunderban islands, Sagar, Moushuni on the Western side of Sunderbans, and Satjelia on the Eastern side, are the subjects of this thesis. These cases share the common trait that they all have solar mini-grids installed on their island, but differ in terms of who implemented them, how they are organized and their political environments. Sagar and Moushuni were chosen as cases because of their long-term experience with solar mini-grids. As a contrast to Sagar and Moushuni, Satjelia is a recently installed case with a different organizational model, which will be further elaborated on in the following chapters.

Sagar and *Moushuni* are two of seven targeted islands for WBREDA's solar off-grid schemes. Of the seventeen power plants WBREDA has installed on the Sunderbans,

twelve have been installed here (Ulsrud et al. in progress). Sagar and Moushuni differ in terms of population, location and developmental needs. While Sagar is one of the largest islands of the Sunderbans, a population of about 200,000, and relatively accessible from Kolkata by train or car and ferry, the population of Moushuni is only around 20,000 and the closest connection to road and rail is two hours away (Vognild 2011:6). Compared to neighboring islands, Sagar has a relatively high score on socio-economic performance. In many ways it is an exceptional case in the Sunderbans context, having a paved main road across the island and a busy business life, as well as earning a lot from religious tourism (Shrank 2008:11-12). Moushuni's remote location, on the other hand, makes the challenges with business development and the sale of agricultural produce much greater. Threats of breaches to embankments from waves from the sea are also a concern; since 1969, the island has lost about 15 per cent of total area, while in the same period, population has risen around 265 percent (Danda 2007:42-44).

The solar mini-grid supplying electricity to the two villages of Rajat and Jubilee on *Satjelia* is implemented by WWF India. Satjelia is a large, remotely located island in the Eastern area of the Indian part of the Sunderbans, close to the Bangladesh border. To reach Satjelia from the more accessible island of Gosaba, one must embark on a two-hour long journey of rides on *bhutbutis, cycle vans* and *auto rickshaws,* an on brick roads still largely devastated by the cyclone Aila in 2009.. Here, a solar mini-grid was inaugurated in March, 2011, shared between the two villages (WWF). The initiative behind the mini-grid comes from the Asian-Pacific Partnership, which secured funding for the plant from the Australian Government and CAT Projects Australia (WWF).

The three islands differ in terms of whether they will need decentralized electricity supply, like solar mini-grids, in the future. As Sagar is a larger and more accessible island, the national electricity grid is planned to reach all households on the island by the end 2012. By August 2011, the grid had reached Sagar and the first buildings had already become electrified, making the future of the existing mini-grids on Sagar uncertain. If people choose to connect to the national grid, a possibility is to feed electricity from the mini-grids into the main grid (WBREDA1, WBREDA2). Moushuni and Satjelia on the other hand are not expected to be connected to the main grid for 15-20 years, due to their remote location and the high cost of stretching underwater cables (WWF). For these islands, decentralized solutions are therefore required for the communities to obtain electricity connections.

2.5 Effects of electrification

WBREDA had two visions for their electrification projects in the Sunderban. First, to provide lighting in homes small businesses, and markets, provide protection for snake bites, and facilitate business growth. Second, the goal was to use renewable energy to supply the electricity (Ulsrud et al. in progress). The main purpose of electrification was to supply electrical power to households for residential use (Vognild 2011:82), most importantly because of *the need for light*. The man who first envisioned 'Solarized Sunderbans', WBREDAs former director Gon Choudhury, describes life without light on the Sunderbans as the

> *(…) vast darkness in which the Sunderbans plunges into daily, after the dusk. The inhabitants of Sunderbans are forced to shut themselves behind their doors after sunset, as electricity has always been a distant dream for them.*
>
> (Ulsrud et al. in progress)

Domestic lightning and streetlights are the main uses of electrical power on the islands. In addition, the inhabitants use the electricity for lighting, table fans, black-and-white TVs, mobile phone charging and radios. Typical use for a household comprises the use of two or three light points, a table fan or a black-and-white television set (Ulsrud et al. 2011).

The solar mini-grids differ in terms of how long they have been in the villages, and so does the extent of developmental effects. However, on all islands, access to electrical power has led to both social and economic change. *Economically*, the electricity has increased and diversified income. Business has improved by improving the process of packing betel leaves and enabling the display of merchandise to attract and serve customers in the evening. *Socially*, people speak of lifestyle changes like the chance to watch TV, listen to radio and use other electrical appliances. Illumination from electric light enables women to do their cooking faster and more efficiently, giving them more freedom to organize their evenings, like helping children with homework or conducting income-generating activities (Vognild 2011:83-87, Chakrabarti and Chakrabarti 2002:38-41). The light improves kitchen hygiene by keeping away insects that can be poisonous if they get into the food, like geckos, fireflies and cockroaches. Access to electricity has reduced discomfort connected to lack of heat and allowed children do

more homework (Vognild 2011:72, 78-99, Chakrabarti and Chakrabarti 2002:38-39). In addition, electric light from street lights and private houses function as "security lights," illuminating public spaces and frightening the poisonous snakes lurking at night, increasing the mobility of residents at night (Vognild 2011:95-96).

The solar mini-grids have led to many positive changes in the lives of the Sunderbanis. Yet, the villagers have been challenged by the decline in the capacity of the technology, and in several cases, the growth of non-compliance. If it is correct, as they say, that electrical power is the most important thing in their lives, why have they become unwilling to comply with the rules?

3 Governing the commons

In the introduction, the Sunderban cases were described as examples of "common resource management," and by that, examples of a plethora of cases found throughout the world where people manage an often limited resource together. Common resources can be natural or human-made, yet they all share the trait that individuals can personally benefit from the resource while sharing costs collectively (Burke 2001:453, Gardner et al. 1990:335). Despite the fact that literature on common resource management has become extensive over the years, cases examining the failures of local communities to govern common resources remain underrepresented – probably for two reasons: Social scientists prefer to write about successful resource management rather than failures, and failures are harder to locate and assess (Poteete et al. 2010:36). The Sunderban cases can supplement literature by illustrating both "successes" and "failures," within the same context. "Successes" and "failures" are not intended as labels, but rather to direct attention to the effect different levels of compliance can have on the resource. It is the variation found between failure and success stories that need further exploration. It is with this in mind that we turn to common resource theories.

3.1 The tragedy of the commons

The most influential publication in the field of common resource management is the essay of "*The Tragedy of the Commons,*" written by the ecologist Garrett Hardin. Published in 1968, it soon captured the attention of a multi-disciplinary collection of scholars and practitioners, including anthropologists, sociologists, ecologists, economists, development planners, and political scientists (Feeny et al. 1990:14). Hardin's theory postulates that when people share resources collectively, the outcomes will always be undesirable – or "tragic." The core of Hardin's argument is that when a collective of people is sharing a resource, it is in the collective's interest to avoid depletion of the resource, but in the individual's interest to draw as much benefits as he or she can. Take a simple example: a community forest has a hundred trees and is used by a hundred families. If all the families separately decide to cut down a tree for

decorating their living room for Christmas, they will deplete the forest. It might be rational (that is, within certain cultures) for families to have their own Christmas three, but for the collective, this would be irrational, in terms of the long-term prospect of sustaining the forest.

Hardin's view on the problem with the commons is far from novel. Variants of it can be traced from the Greek philosopher Aristotle in 300 years B.C., to contributions in the 19th and 20th century (Feeny et al. 1990:1-2). Aristotle pointed out the danger of coupling privileges without obligations, a situation that that can arise from common land: "What is common to the greatest number gets the least amount of care. Men pay most attention to what is their own: They care less for what is common" (Rothstein 2005:20). More than a decade before Hardin presented his theory, two modern resource economists, Gordon (1954), and Scott (1955), developed the first version of the conventional theory of the commons (Feeny et al. 1990:2). But the one who inspired Hardin was William Forster Lloyd, or more specifically, Lloyd's text called *Two Lectures on Population,* published in 1833 (Hardin 1998, Lutts 1984:287). Lloyd describes how a man's motives to work decreases in cases where he has agreed with one or more persons to share the efforts of their labor. When the result of the men´s labor turns into common property, Lloyd argues, it will be in each man's self-interest to relax and do less of his work load, because the sharing of input and output would make him bear only half the loss.

After reading Lloyd, Hardin became pessimistic in his view on the ability of people to make choices that would also benefit the collective. Hardin had originally assumed, on the basis of Adam Smith's concept of the "invisible hand," that the sum of separate ego-serving decisions ultimately would lead to the best outcome for the population as a whole. But when discovering Lloyd's work, Hardin realized that in a situation where demand grew in step with population, while supply remained fixed, any herdsman acting as Smithian individuals would eventually be trapped by his own competitive impulses (Hardin 1998). In other words, the sum of separate ego-serving decisions would destroy the individual's livelihood in the long run, by straining the carrying capacity of resources.

Following this insight, Hardin wrote "The Tragedy of the Commons", a short essay based on a thought experiment taking place in a pasture open to all. Herdsmen let their cattle graze on commonly held land, and because all herdsmen are rational beings,

Hardin predicted that each and every herdsman would maximize his gain by keeping as many cattle as possible on the land. The problem is that if all herdsmen operate on the same logic, the result would be overgrazing of the pasture, leading to an undesired outcome for all. In Hardin's words:

Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

(Hardin 1968:1244)

According to Hardin, this type of tragedy will always take place in common resource situations. He characterized the commons as *pejoristic systems* a term derived from the Latin word *pejorare*; "to become or make worse." The pejoristic system creates an unacknowledged common, said Hardin, giving people more motivation to draw from than add to the common store (Hardin 1974:565). Then, we might ask, can the lack of compliance on the Sunderbans be explained by the electricity supply being based on common resources? If Hardin's theory is correct, the customers on the Western Sunderbans are now facing a classic variant of the "tragedy."As long as access to electricity will remain open for customers, they will rush towards "ruin for all," unwittingly destroying the technology in the long run.

3.2 Abandoning the commons?

Hardin remained pessimistic with respect to the commons, but he did propose some solutions. As an ecologist, he was concerned about the world´s resources, and wanted to find ways to sustain them. To avoid ruin for all, he called for "a reexamination of our individual freedoms to see which ones are defensible" (Hardin 1968:1244). To Hardin (1968:1245), we have two possible ways to infringe on these freedoms and solve the tragedy. The first is to sell the land off as private property. By doing that, every man would only be accountable for his own property, giving him incentives to use it correctly. Hardin's solution resembles the call from Bhumit on the Sunderbans. Bhumit had started to favor *private* forms of electricity supply, such as solar home systems, in favor of the collectively shared mini-grids. Therefore, he would be likely to agree with

Hardin about this. But at the Sunderbans, some customers also wanted to find solutions for keeping the mini-grids. Would that inevitably lead them to the tragedy? Not necessarily. Hardin proposed a solution these customers could use, as well. They could keep control of the resource under a strong and farsighted governance by centralization of judicial control over the resource. This would imply abandoning the community management system that earlier literature had praised them so extensively for, and replacing it with governance and control by state agencies.

Hardin´s logic is compelling, and many of the customers of the Western side might find his solutions sensible. However, as scientists and outsiders to the situation, we can hardly be satisfied with this. What we aim to find are factors that can explain *the variations* between these cases. And in Hardin's picture, an important piece of the puzzle seems to be lacking. Hardin predicts that all resource management would fail under communal management, making him unable to explain empirical cases where people do successfully manage common resources together. Hardin's theory is an explanation for why people are sometimes *incapable* of sustaining a resource collectively, making the theory itself incapable of explaining why people are sometimes able to cooperate. This leaves our understanding of the Sunderban cases with large gaps.

In the years following Hardin's essay, other scholars have tried to bridge this gap. The political scientist and Nobel Laureate in Economics Elinor Ostrom is the one of the best known of the newer scholars within the field. Scholars like Elinor Ostrom, Amy Poteete, Marco Janssen and several others, have developed what they call "a new theoretical framework of the commons." These scholars, often called CPR analysts, have not only studied "tragedies," but also successful cooperation over common resources. Their theoretical framework was initiated after several researchers, through separate field studies, discovered that cases of sustainable common resource management could be found all over the world (Rothstein 2005:49, Poteete et al. 2010:39). After Hardin´s essay, common resource management was largely seen as an unfit property regime, but the initiative of new studies – with methods ranging from laboratory experiments, case studies, agent-based modeling and comparative field-based methods – challenged this view. The aim of the studies was to synthesize empirical findings to draw up a new and more empirically grounded framework of the commons (Poteete et al. 2010:40-41).

To simplify it, we could describe Hardin's argument as following this logic: Common resource management is impossible because self-interest is the main

behavioral driver of mankind. The new CPR analysts' framework departs from this view. The framework can be seen as an extension and gradation of Hardin's model, yet two things are done differently. Several of Hardin's assumptions are revised and variables that can explain the outcomes in a broader subset of cases are traced (Poteete et al. 2010:222). According to scholars like Poteete, Jansson and Ostrom, micro-variables, like group size and heterogeneity, and macro-conditions, like market pressures, property rights and government policies, are not predicted to influence common resource situations in a uniform way (Poteete et al. 2010:218-220).Instead, factors such as cognitive limitations and risk, social interactions, norms and interactions among contextual variables are seen to have significant explanatory potential (Poteete et al. 2010:219-220).

Their studies have predicted that successful cases of common resource management will be characterized by well-defined boundaries, existence of arenas for conflict resolution, methods to monitor and sanction nonconformance, as well as internal policy making over time (Poteete et al. 2010: 245, Gardner et al. 1990:335). In addition, those who monitor and control the behavior of users should be users in their own right, or be given a mandate by all users, and those affected by rules should be able to participate in decisions to change them (Poteete et al. 2010: 31-46).
These CPR analysts believe outcomes of common resource management need to be explained by a *combination* of factors. Explanations must be found in both human behavior and context, and claim that if we want to find ways to make the commons work, we need a theory that allows for complexity (Poteete et al. 2010:219-223).

However, the customers at the Western side of the Sunderbans are looking for solutions, not explanations. The new theoretical framework theory might explain the variations in the Sunderbans, but it does not offer any easy solution for the customers' problems**.** It can identify variables that can *explain* the situation, but it can not offer a straightforward solution for how they can make people comply with the rules. But the Sunderban customers want to find a solution to the problem immediately. Why should they consider Ostrom and the others' complex strategies when Hardin has proposed a straightforward solution? By following Hardin's assumptions, they would have the solution laid out ready for them at the table; they could implement solar home systems or leave the resource to the state, and the tragedy would be avoided.

3.3 The problem with “easy” solutions

There are two problems here: *First,* the “easy” solution is not necessarily problem-free. Deciding on how resources should be distributed as private resources is not easy. Not all resources can easily be divided, such as fresh water in an international basin or large marine ecosystems (Ostrom et al. 1999:278)**.** Implementation of solar home systems would be possible, but still not necessarily the best solution in the long run. Solar home systems can face similar problems. The cost of solar home systems is high, and incomes of solar home system users are usually higher than average, creating difficulties in targeting the groups who are most in need for it. Batteries are also the most expensive part of a solar home system, and the life time of batteries can sometimes be as low as a year. In addition, inadequate user training often leads to bypassing the charge controller, which is a frequent cause of malfunctioning batteries (Niewenhout 2001:467-468). Also, there are certain advantages with solar mini-grids compared to solar home systems, such as financial benefits if the village is densely populated (Chaurey and Kandpal 2010:3128), and the variety in the use of electrical power is potentially higher for mini-grids (Ulsrud et al. 2011:3).

Neither is state governance a guarantee for sustainable use of the resource (Feeny et al. 1990:2, 11-12). Central regulation of resources has often resulted in the opposite of what as intended, and is complicated by problems of corruption and inefficiency (Ostrom 2008), Rothstein 2005:48-49). In some cases, common property resources can *de facto* belong to the users of the land in the villages, even though the legal ownership of the resources rests with another agency (Jodha 1990:65). Transformation of common pool resources into *de jure* state property have therefore, in many cases, resulted in the creation of *de facto* open access (Feeny et al. 1990:12). This has accelerated, instead of hindered, processes of overuse. Hence, it becomes possible for users to exploit others and rivalry may give rise to divergence between individual and collective rationality.

Some instances of what appear as “tragedies of the commons” are in reality examples of government failure. In developing countries, like India, such incidents may for instance take place when resources are nationalized before the state has developed its management capacity (Feeny et al. 1990:8, 12). State governance is therefore not

necessarily the best way to solve the "tragedy" for the customers at the Sunderbans, as it might end up i creating even worse "tragedies."

Second, it is not certain that we can rightfully generalize the findings of the grazing land scenario. First, we need to consider the methodological basis Hardin's theory rests on. For instance, had he considered all the relevant variables of his case? The scenario of "The Tragedy of the Commons" is generally understood to take place in the common grazing lands of medieval and post-medieval England. Scholars have criticized Hardin for historical ignorance, as the commons in medieval England operated successfully for several hundred years, before the degradation of the grazing land started (Feeny et al. 1990:10). Hardin's explanation of the degradation with "a tragic flaw of human nature" (Lutts 1984:292) is also questioned. Other scholars have explained the degradation of the grazing lands in England in the 18th and 19th century with abuses by wealthy land owners, agrarian reform and changing farming practices (Cox 1994:56-61).

A revisit to definitions is needed, as several scholars have confused the general term "common resources" with "common property resources", and Hardin is no exception. For instance, the abbreviation *CPR* is frequently employed to describe both common *pool* resources and common *property* resources. CPRs can refer to village pastures, community forests, wasteland, tanks, village ponds, rivers and riverbeds and common dumping and threshing grounds (Pasha 1992:2499). Common pool resources can be defined as natural or man-made resources, where access is open to *everyone*. Common property resources resemble common pool resources, but are resources that are available to a *community.* Community members share the resources among themselves, without any exclusive ownership or access rights to the resource within the community (Jodha 1985:247). This implies that access is open within the community. Common property resources share two important characteristics: excludability (control of access) and subtractability. *Excludability* refers to the fact that the resource is of such a nature that controlling access to it by potential users may be costly. *Subtractability* implies that the resource unit harvested by one individual is not available to others and that each user is capable of subtracting from the welfare of other users.

In addition to the two differing CPR definitions, four ideal types of resource management can be defined: open access, private property, communal property and state property (Feeny et al. 1990:4). As these are ideal types; they may be overlapping,

or be combined in different ways and vary within, but the essential point of usage rights remains. *Open access* resources are characterized by absence of well-defined property rights, where access is unregulated and open to everyone. Under *private property*, the rights to exclusion of use and regulation are assigned to individuals or groups of individuals, wherein the rights are often exclusive and transferable. Under *state property*, it is the government who holds the right to the resource and designs rules of use and regulation. Rights of access and use may in such cases be either open for all or highly restricted. Under *communal property* (also called common property or simply a common in the literature), the resource is shared by an identifiable community of interdependent users, with equal rights to access and use (Feeny et al. 1990:4-5). As these are ideal types, many borderline cases are found.

Attempting to understand environments sharing different combinations of access and rights within the same theoretical structure would be inappropriate (Gardner et al. 1990:340). Following this, Hardin's theory, as it is addressing open access situations, should only rightfully be applied to cases where access is open to all users. Yet, Hardin generalized his theory to several situations, not only to other cases, but also through scales. He applied the micro-scenario of the grazing lands to macro-situations like global population growth, genetics and development aid, arguing for policies such as abandoning food aid to starving nations to avoid "global commons," and for eugenics practiced prior to birth to avoid "genetic commons" (Lutts 1984:288-289, Hardin 1968:1246, 1248).

There are several dangers with scaling up and scaling down between micro and macro situations, like Hardin does. Even though points of tangency between common resource situations on local and global levels exist, we cannot simply assume that mechanisms at the micro and macro level are the same (Keohane and Ostrom 1995). When Hardin leaps from farmers land plots to a global agricultural common without addressing their differences, his theory is weakened (Lutts 1984:291).

3.4 Considering other solutions

Despite its short length, Hardin's essay of the commons proposes to both identify a cause and find a solution. Hardin's own tendency to generalize his findings has led others to follow. In the years following his essay, the theory became the most widely

accepted explanation for overexploitation of common resources (Feeny et al. 1990:2), and has later legitimized a wide range of politics. While some have used Hardin's theory as a defense of liberalism, others have viewed his thoughts as 'socialist' (Lutts 1984:289). A wide range of scholars and officials have relied upon Hardin's theory to justify the need for centralized control of resources (Feeny et al. 1990:2). Considering also the problems associated with private and centralized management, it feels appropriate to ask, could other solutions be considered? The answer is yes, according to Elinor Ostrom and her team of scholars. We have one other option to escape the tragedy of the commons: *collective action.*

Collective action, also called "self-organized action," is defined as a phenomenon that occurs "when more than one individual is required to contribute to an effort in order to achieve an outcome" (Ostrom 2004:1). Collective action-situations arise when people come together to supply themselves with goods and services they all need, but cannot provide for themselves individually. Simply put, they cooperate. The list of types of common goods that people can find cooperation around is endless. People can agree on not cutting down their forests for Christmas, not using more electricity than the capacity of the power plant they draw from allows, and so on. The new theoretical framework of the commons approach differs from Hardin's, as it is not merely grounded on type of property and enforcement. Instead, it directs attention to a variety of factors that can affect peoples´ probability to engage in collective action.

Several models, such as Hardin´s "tragedy" and Mancur Olson's *The Logic of Collective Action* (1965), have focused widely on the difficulty of collective action. They are focusing at *the barrier of cost* for individuals, keeping them from undertaking actions that would have kept every party better off. Very simply, the problem of facilitating collective action is that it can be very hard to make individuals cooperate in situations where they all have an incentive to free ride (Putnam 1993:163-164).

While the above mentioned theories claim that the barrier of individual cost is very hard, in fact, almost impossible to overcome, Ostrom and others believe certain situations can be conducive to collective action, while other situations discourage it (Feeny et al. 1990:11). Where Hardin regarded people as unable to voluntarily cooperate over common resources, contemporary CPR analysts regard other characteristics within the specific situation as determining whether self-organized action is possible. Their approaches to the phenomenon are highly contradictory, and it

may appear strange that two theoretical approaches within the same field of study can argue so differently. Both approaches are concerned with people using resources unsustainably. Both seek to explain why the social world can negatively impact the physical world. And both search for solutions. But why are they arguing their points in such different ways?

Their approach to the subject is very different. Take Garrett Hardin, for instance. He first identified the *outcome* of common resource situations, then explained it with certain characteristics of the case he approached. Ostrom, Poteete and other scholars, approach it from the opposite angle. They start by investigating a number of different *factors* found in different situations. They then employ these factors, to explain different outcomes. Ostrom seeks to explain why people are sometimes able to cooperate, and sometimes not, while Hardin rejects the possibility of voluntary cooperation in common resource situations. Is there a reason for Hardin's lack of faith in peoples´ ability to self-organize?

The scholars' views are rooted in different views of human behavior. Hardin assumes users to be short-term, profit-maximizing actors, holding complete information about the situation, and homogenous in term of assets, skills, discount rates and cultural views. By regarding individuals as profit-maximizing, it is expected that individuals will always choose the strategy that benefits him or her the most. This leads to the claim that actors faced with a situation which brings more immediate benefits to themselves if they *do not* cooperate, while others will, always choose non-cooperation (Poteete et al. 2010:217-218). Elinor Ostrom's perception contrasts with this theory. She categorizes Hardin's view as a variant of *rational choice theory,* which is only one model in a whole family of models that can be used to conduct analyses of human behavior. Rational choice assumptions can be seen to rest on a thin version of intentionality, rationality and interests (Rothstein 2005:30), which Ostrom describes as "a model of human behavior where individuals face highly competitive settings, and do not remain in the game unless they focus narrowly on benefits to themselves" (Poteete et al. 2010:221).

The word "interest" is essential to analyze here. The concept has a seeming neutrality which often leaves it unquestioned (Hertzberg forthcoming). However, rational choice models based on a 'thin' version of self-interest can be seen as having certain problems. According to Ostrom, Poteete and Jansson, human behavior should be seen as shaped by social preferences, which in turn is a combination of the individual' s

underlying norms, for instance norms of fairness and justice, or the direct experience with others in a given setting (Poteete et al. 2010:224). *Norms* can be defined as internal evaluations, positive or negative, attached by the individual to certain forms of action in specific types of situations. That people act according to norms can therefore be one way of explaining human behavior, and one of the recommendations for developing an improved theory on the commons is to better account for the *normative influences on human behavior* (Poteete et al. 2010:219-220).

3.5 Trust as a "bridge"

However, if norms are accounted for in the Sunderban situation, two challenges arise. First, the situation on the Western side cannot be *solved* by norms. We can neither simply implement norms, nor assume that individuals will adapt to prevailing norms. Norms can work in some cases, not in others, because perceptions of doing 'the right thing' can change. Norms can also exercise both protective and devastating effects on resources (Poteete et al. 2010:225). The implication of this for the Sunderban cases is that although people might have complied because of norms in the early phase, norms will not necessarily solve the current problems. How can we re-introduce norms if they are already broken? The second challenge is that a mere reference to norms is a poor explanation. We cannot simply *explain* the Sunderban cases with norms, even though we can point to norms. It leaves us with an insufficient explanation, because if compliance can be explained by norms, new questions arise. How did the norms come into being, which factors did they rely on and how did they change?

Hardin's and Ostroms' contributions leave us with contrasting explanations to our phenomenon. On the one hand, there is Hardin, focusing on the drivers of self-interest and who, despite the methodological problems of his theory, has exercised such an important influence on the field that he cannot be ignored. Then, there are the contemporary CPR analysts, with Elinor Ostrom leading voice, challenging Hardin's view on both human behavior and social organization, by opening up for a view that human behavior can also be guided by morals and that we should consider other aspects of institutional norms than property rights. Ostrom, Poteete and the rest of their academic team account for *both* self-interest and norms in their theoretical framework. The difference is that self-interest is given less credibility than it has with Hardin. However,

norms and instrumental rationality appear as concepts worlds apart. How can we account for both norms and rationality within the same explanation of a phenomenon?

First, there appears to be a dire need, within common resource situations, to acknowledge that we are approaching two separate phenomenon. One process is the cooperation or non-cooperation in the form of social dynamics among individuals, the other is the effect of social interaction on the physical world – on the resources on which we depend. It might be prudent to keep these analytically separate, for two reasons. First, the explanatory force of social science perspectives on the dynamics of our physical surroundings is limited. Second, to analyze both these processes together requires exceptional theoretical refinement. It might require a simultaneous approach by different disciplines. Considering the scope of this thesis, it is preferable to attend to only one of these processes–the social.

Still, the question remains: how should the Sunderban cases be approached? How can we improve the perspectives derived from the common resource literature, to further understand the Sunderban cases? Poteete, Jansson and Ostrom postulated that one of the important factors determining whether a self-governed management will succeed over the long-term is whether the institutions that people design sustain high levels of trust. They have emphasized that trust, along with the dynamics of change, are two of the factors in common resource situations that need to be better understood (Poteete et al. 2010:226). Trust has the potential to fill a gap within the common resource literature. The concept might bridge the micro-macro gap we find between the various elements we need to understand here: human behavior, the design of social institutions, and interrelation between contextual elements.

The degree in which institutions and collectively agreed upon rules are effective and robust can be seen as dependent on trust. If people believe that others are likely to succumb to moral hazards, they will not support policies that can pose such hazards, and will attempt to subvert them if such policies are adopted (Offe 1999:45). It is therefore not solely self-interest, but the wider cognitive notion of trust that should be employed to approach the social processes of common resource situations. But as trust is a somewhat vague notion commonly employed in (and obscured by) everyday speech, trust requires further understanding. It is this subject that we will turn to in the following chapter.

4 Trust in the Commons

Attempting to explain the prevalence of norms, degrees of self-interest, levels of compliance or non-compliance, such as in the Sunderbans, is essentially trying to understand human actions. All human actions are characterized by an orientation towards an uncertain future. It is this uncertainty that makes human actions so unpredictable – and risky.

Trust, being the cognitive premise in which we enter into interactions with others (Offe 1999:45), can be a way to handle the uncertainty, The Polish sociologist Piotr Sztompka illustrates it well when he says that all humans: "(…) are made to gamble, to make bets on the future contingent actions of others. In such bets we deploy trust." (Sztompka 1997:7). This relates to one of any social order's most all-encompassing problems – other people have the freedom to act differently than we do, and vice versa (Luhmann 1999:17). To handle the uncertainty of others' actions, people base their actions either on knowledge or on an available means to control the situation. Various solutions to reduce this uncertainty exist, such as the development of shared norms, or, as Garrett Hardin called for, state governance to control social actions. Similarly to this type of formal control, trust is a way to reduce social complexity (Luhmann 1999:18).

The word "trust" can appear vague in everyday speech. Yet, the notion has the potential to provide rich understandings of social life, if approached analytically. Through the development of our societies, with steadily increasing social complexity and interdependence between groups, societies and nations, trust has increased in its importance. Social action in modern societies is often described as being coordinated by three major media: money, authority and knowledge (Luhmann 1999:23, Offe 1999:42-43). These are social coordinators, by coordinating the actions of market participants, constraining and enabling citizens' actions through democratically elected sanctions, and generating awareness of and cognitive skills regarding current and foreseeable future problems.

However, they are not sufficient to provide a *complete* vision of social order, as they do not incorporate the informal modes of interaction. Trust is a prime example of the informal resources required to ensure social stability (Offe 1999:43). Trust reduces social complexity, replacing an outer security with an inner security (Luhmann

1999:22), and is one of those things that make us dare to cooperate with others in order to solve collective tasks (Gulbrandsen 2000:1). If we want to explain why a society is possible at all, why it does not fall apart, trust cannot be ignored (Lagerspetz forthcoming).

4.1 Dimensions of trust

Trust is as hard to grasp (Grimen 2009:12) as it is in its lack of an essential meaning. Rather, it has a variety of conflicting meanings (Hardin 1999:24). When trust is used analytically, useful results can be obtained by basing it on different definitions of the notion, rather than only one theory (Lagerspetz forthcoming). To shed light on several *dimensions* of trust, different theoretical contributions, such as from Niklas Luhmann (1999), Russell Hardin (1999), Harald Grimen (2009), Piotr Sztompka (1999), Trygve Gulbrandsen (2000, 2005), Claus Offe (1999), and Olli Lagerspetz (forthcoming) will be used in the discussion.

Trust consists of three parts: *someone* trusts *someone* else with respect to *something* (Grimen 2009:13). This means that trust is *conditional;* people can be trusted on some matters, but not on others. For instance, the Sunderban customers might not trust others to comply, while still having confidence in their neighbors in other situations, such as trusting them to look after their children.

In this case, trust is *specific* as it is restricted to particular situations, in the sense of being valid only for certain actions of the person or institution, to specific areas of it or in certain contexts (Gulbrandsen 2005:118). A common distinction is also made between *particularized* and *generalized* trust. While particularized trust is trust limited to one's family or group, generalized (or "thin" or impersonal) trust is trust extended to strangers (Warren 1999:8). This type of trust can be difficult to understand, because it is difficult to grasp why we should trust people we do not know well at all (Delhey and Newton 2005:311). Even though the Sunderbani villagers might trust their neighbors to look after their children, we cannot expect them to trust strangers in the same way. To generalize trust to strangers is more *risky* than giving particularized trust, and highlights the *vulnerability* in trust: a relationship cannot be defined as a trust relationship if it does not involve a real chance of disappointment (Luhmann 1999:21).

Distrust is often referred to negatively. Distrust can imply that social interaction is prevented or disrupted, and has the potential to destroy both personal and professional relationships, as well as social and economic development (Grimen 2009:91). Trust on the other hand, reduces complexity, and is therefore frequently seen as desirable. The sociologist Niklas Luhmann, for instance, sees trust as functionally preferable to distrust, because trust is psychologically easier to handle and better at reducing complexity (Luhmann 1999:15, 126).

Does this make trust something we should always strive for? Some, like the theologist Knut E. Løgstrup, see trust as morally good and distrust as evil (Grimen 2009: 22). While Luhmann also prefers trust to distrust, Luhmann's conclusion is functionally grounded. He weighs trust and distrust as functional equivalents, without any moral foreboding. Trust might be preferable, but is still not always possible or rational. It would, for example, be irrational to trust someone you already know is not trustworthy (Grimen 2009:34-37). Neither can it be considered a moral requirement to trust someone who clearly will take advantage of your trust to cheat or harm you or others (Hardin 1999:24).

This highlights two additional dimensions of trust: trust is not just utilitarian and not just moral (Rothstein 2005:56-58). The ethical concept of trust, advanced by Løgstrup, is problematic because it implies that the person is capable of knowing when trust should be employed and when distrust is the most sensible approach. The problem here is that no one is capable of this (Luhmann 1999: 26).

Different explanations of trust rest on different views of how the concept should be defined. Trust can be defined as an *attitude* held towards other people, institutions or social systems (Gulbrandsen 2005:117), or as a way to *act* (Grimen 2009). Another distinction is drawn between *confidence* and trust. Both confidence and trust can be used to reduce complexity. But while confidence is rooted in our past experiences with others, trust and distrust belong to the future. However, when societies grow more complex, the number of situations where we need to interact with strangers grows, increasing the need for trust.

Both trust and distrust are concepts, feelings, or attitudes that we learn. Modern societies have magnified the importance of this, demanding that we increasingly be able to interpret and control appearances. When a child learns that the other person is also an "I," having its own separate freedom to act, the child can also learn that this freedom

is something he or she can learn to trust (Luhmann 1999:20). But the child needs to also learn that others' freedom to act cannot be trusted in all cases, as strangers or others can have dishonest motives that are not revealed to us.

Often, the only way to manage such situations is through interpretation. While some trust is spontaneous, trust can also be based on reflection: people often interpret, judge, and weigh options and possible outcome before extending trust. Such reflections are often made when a trust relation is established. Later, it is more or less taken for granted, unless the trust relation is somehow violated. The absence of reflection characterizes a range of situations in our daily lives. We trust the pilot of the flight we're boarding, we trust the politicians whom we vote for, as well as the police who protect us and friends who might be asked to keep our secrets safe (Gulbrandsen 2000:1).

4.2 Trusting institutions

A relationship of trust grows between individuals, but it is not exclusive to individuals. Much of the literature speaks of trusting institutions, and is in agreement that we should distinguish between trust for institutions and trust for people.

Institutions can be complex in ways that people are not, and in understanding both, relative to trust, we can see different problems arising with each (Grimen 2009:118-119). One of these differences is that with institutional trust there is an important *procedural trust* component. This is basically having trust in institutionalized practices and procedures.

For instance, in many countries people trust democracies because they see its procedures, such as elections, representations and majority vote, as the best ways to satisfy their shared interests as citizens (Sztompka 1999:44). Trust in institutions can either be based on trust in particular individuals connected to that institution, or extended to the organization itself – to its resources, management philosophy, systems for quality control or the competence of its employees (Gulbrandsen 2005:118). In many ways, institutional trust is more complex than personal trust, as it becomes necessary to trust in the capabilities and will of *both* the institutions and its representatives.

It is worth questioning whether we actually trust institutions, or the individuals representing them? All interactions with an institution are also interactions with its representatives, making institutional trust dependent on the individuals who monitor

and enforce its rules (Gulbrandsen 2005:117). If the representative encountered demonstrates an inability doing his or her job, the signals transmitted can leave us with a negative impression of the institution. The discussion of whether we can trust institutions bear a resemblance to the discussion on definitions of personal trust. Russell Hardin (1999:30.39) suggests that while we might not trust an institution, we can still *depend* on its apparent predictability. He sees our relationship to government not as one based on trust or distrust, but at best one driven by inductive expectations.

Institutions facilitate trust between individuals by limiting the perceived risk of trusting strangers, and "inspire compliance," as they can have a formative moral impact on people's behavior (Offe 1999:72). But we should ask ourselves whether trust in institutions is always desirable. The common wisdom is that a country's citizens must trust the government for it to function well. But should we always strive to trust government? Not necessarily. Such a claim is normatively based, and objections can be raised. As citizens do not always know enough about government, and agents of government do not always have incentives to act in the interest of citizens, trust in institutions is, in certain cases, unwise (Hardin 1999:21-22).

4.3 Reasons for trust

However, there are many instances where trust *is* seen as desirable, in the sense that it would be advantageous to trust. If we want to find ways to facilitate trust, we need to understand the reasons for giving it. Numerous factors can affect trust, such as characteristics found in the cultural context, the individual or the institutions involved in the situation. The inter-relational strength of these depends on the context, and different combinations lead to different outcomes in the degrees of trust.

One of the foundations of trust is found in *expectations*, as trusting implies having expectations of the receiver of trust, and the outcome of the trust relation. The significance of the trust giver should be acknowledged, too, as trust in its broadest sense can be understood as confidence in our own expectations (Luhmann 1999:31). Expectations directed towards a trust relationship can be either *predictive* or *normative*. Predictive expectations are built on experiences or knowledge, while normative expectations rest on ideas about what a person or institution *should* do, based on generally accepted norms (Grimen 2009:39-41).

This view is simplistic, however, as all sorts of variations can occur. For instance, it is rare that people act solely out of normative expectations, without relying on any knowledge or signs of trustworthiness by the receiver of trust. Most often, trust is built on some degree of knowledge (Offe 1999:53), which again builds on experiences and available information. The experiences a person has with another person or institution serve as an important foundation for trust, because these are indicators of the person's actions in the future. Social systems that bring individuals into regular contact with each other will contribute to increase their mutual trust (Gulbrandsen 2005:121).

However, knowledge or past experience with others is not the only grounds for which expectations regarding trust relationships can be built. Trust can also be based on *appearances*. By following Luhmann (1999:18-21), we see that the extension of trust, to an increasing extent, is based on judgements of others' appearances. Abilities to interpret such signs are therefore important, yet they will never be more than signs – they leave the trustworthiness uncertain. Here, the relationship between control and trust becomes more evident. As we can never know whether the interests of those working for institutions incorporate and protect our own interests, we rely on various control mechanisms in the system to be able to trust institutional workers who we do not know (Grimen 2009:47).

Levels of trust within a society are often measured as the degree of generalized trust. Generalized trust can aid us in building large-scale, inter-dependent social networks, and is connected to several tenets underpinning democratic culture, such as tolerance for criticism and pluralism (Warren 1999:9). This form of trust is therefore seen as desirable, yet very unevenly distributed between countries and societies.

Variations in levels of generalized trust correlate to different degrees of wealth, type of governance, degree of voluntary associations in civil society, religion and culture (Delhey and Newton 2005:311-314). For instance, wealth and trust were found to be strongly correlated in a survey-based comparative study of 60 nations. The same study found a correlation between education and trust, that agricultural societies have a low level of trust, and that public corruption had a major influence on the level of trust among citizens (Delhey and Newton 2005:318-323).

Studies have found variations *within* the same societies, as well. These are often explained as effects of socialization, or of different levels of inequality. For instance, whether people are likely to trust institutions can depend on their access to social and

economic resources (Gulbrandsen 2005:119). The higher the availability of resources, such as money and knowledge, the less does an individual need to trust others or institutions. At the same time, there is a higher probability of them trusting others, as they have less to lose (Offe 1999:72). The economic and cultural elite have for instance been found to have a higher average level of trust more than "average people" (Gulbrandsen 2005:132).

However, one does not have to be rich to be able to trust. High reserves of economic or cultural capital will not enable trust either if one's childhood home was characterized by insecurity. The social-psychological approach to trust emphasizes that trust is something we learn. Our experiences in childhood shape our "ontological security," and this security determines our willingness to extend trust to others (Giddens 1991:43-49).

Equality between members of a community, group or nation is often seen as conducive to trust, and distrust as the opposite (Delhey and Newton 2005:312). Trust or distrust may be targeted at social roles, like race, gender, age, ethnicity, religion, wealth, or occupations. We are less likely to trust the bazaar merchant or prostitute than a doctor or a priest, and public officials, police officers and politicians may also fall into the class of people we hesitate to trust at first encounter (Sztompka 1999:41-43). People often tend to trust those who share similar characteristics with themselves, and show more suspicion of "others" – especially if no institutional mechanisms ensure trust.

Theories also contend that institutional trust varies with the degree of social and political distance between citizens and the political institutions with which they interact: the greater the distance to social and political institutions, the greater the distrust (Gulbrandsen 2005:119-120).

4.4 Trust in social dilemmas

Can trust be used as a solution to the "commons" problem? The political scientist Bo Rothstein has approached Ostrom's problem of collective action through the notion of trust, and its sister-concept "social capital." Rothstein (2005) studies *social traps*– a variant of problems often called social dilemmas. Social dilemmas can be seen as the problem of many names – *Provision of Public Goods, Problem of Collective Action, Tragedy of the Commons* and *the Prisoner's Dilemma.* The list is long, illustrating the graveness of

the problem. Basically, social dilemmas highlight the social part of the term *common resource* – the objective structure of individual benefits and collective costs found within cases where people manage resources together (Burke 2001:453).

Bo Rothstein employs the metaphor of the social trap to approach this, a term originally introduced by the psychologist John Platt (1973). The trap is seen as an "umbrella term" for strategic situations where social actors' behavior is determined by their assessment of others' future actions. It is as a kind of meta-problem that other social and organizational problems, like environmental problems related to excessive use of natural resources, can be sorted under (Rothstein 2005:18-19). The "trap" refers to the difficulty of escaping once a group, an organization or a society has ended up in this sort of situation (Rothstein 2005:12, 18).

Both trust and the notion of social capital are important in Rothstein's theory of the social trap. Rothstein defines social traps as situations where individuals, groups or organizations are unable to cooperate due to mutual *distrust* and lack of *social capital* (Rothstein 2005: 18). And, according to Rothstein, the only way people can escape social traps is to produce sufficient reserves of social capital (Rothstein 2005:205). Social capital is often defined as features of social organization, such as trust, network and norms which, when combined, can have the potential to facilitate coordinated collective action (Putnam 1993:167). Its utilizing function can be seen in two ways: as self-interest or as the utility of everyone else's social capital – especially other peoples' *trust* in each other (Wollebæk and Seegaard 2011:25-30).

Elinor Ostrom regards social capital as one of the necessary components to make institutions of the commons work effectively. She defines social capital as something that is created when individuals learn to trust one another to make credible commitments (Ostrom 1994:20-24).

For Rothstein, social trust is possible due to *the logic of the strategic game of the second order* (Rothstein 2005:207). Rationality will fail us in facilitating cooperation in strategic games, as cooperation will never be the first choice of any political group or agent. However, cooperation is possible in what Rothstein calls "the choice of the second order." When individuals face a given situation for the first time, they might associate it with substantial risk, but when facing it for the second time, the individuals might prefer some cooperative mechanism of enforcement (Rothstein 2005:199,205-207). Garrett Hardin's focus on instrumental rationality can explain why he had no faith in voluntary

cooperation. When rationality is seen as the only guidance to human behavior, collective action is impossible in cases where mistrust is already widespread – as we can only morally, not *rationally,* decide to forget threatening or destructive behavior (Rothstein 2005:205).

Social capital has been highlighted as the "binding cement" that facilitates the cooperation on which we base democracy (Rothstein 2005:48), and frequently is suggested as the solution to all sorts of social problems. However, there are reasons to be careful with the use of this notion, as it has met with criticism. For instance, it has been criticized for its logical circularity. By being a property of communities and nations rather than individuals, social capital is simultaneously a cause and an effect. A successful conceptual departure from individuals to structure will therefore require significant theoretical refinement.

Also, the term's predominant focus on the positive consequences of sociability can neglect that social capital also can have less desirable consequences (Portes 1998:2, 15-18, 19-21). Rothstein is also careful with his application of the notion, for instance, by employing a definition where *norms* are excluded. His argument is that social norms, worldviews and belief systems are causally related, making it unacceptable to combine them into one idea. Rothstein also believes the concept should incorporate both trust and network, but that these should be kept analytically separate, with less emphasis on the latter. Rothstein argues that social trust is the most fundamental ingredient of social capital, as not all types of social networks produce desired forms of cooperation. Quite the opposite – many interpersonal networks produce the antithesis of trust, such as mistrust or hatred of other people, and such forms of trust do not produce the desired reserves of social capital (Rothstein 2005:54-56).

Trust is seen as a useful concept with which to analyze the Sunderban cases, for three reasons. First, notions of trust and distrust provide a more dimensional, nuanced and clear view than social capital alone. Second, with the existence of norms as a potential aspect of our explanation, caution is required when considering social capital. And finally, social capital is not the only factor that can facilitate cooperation. By employing the notion of trust analytically, we might discover more factors to explain our phenomenon.

4.5 Trust, technology and change

Analyzing the customers' reasons for complying or not complying in various forms of trust relationships will not lead to a general law. To claim that we have found such a law would justify the use of "black-box" explanations. We might accept that when one set of variables move, another set of variables also move, but still lack a theory of why one set moves the other (Rothstein 2005:34). If we are to explain why different property regulations does not always lead to the same outcome, we need to identify causal mechanisms instead of laws, because without social mechanisms, we can produce only predictions, not explanations (Rothstein 2005:33-34). It has already been stated that the explanation of social processes should be kept analytically separate from its effect on the physical world. Still, to provide a workable explanation, we must also consider a physical variable that might also have influenced a social process: basically, the technological components of the solar mini-grids.

By seeing technology as part of the explanation, we can see technology and social interaction as forming socio-technical systems. The supply of electricity from the mini-grids have specific configurations of social and technical components: solar photovoltaic panels, power plant buildings, battery banks, power conditioning units (battery chargers, inverters, etc.), electrical poles and lines, operators, owners, contractors for operation and maintenance, local committees, routines for and knowledge about operation, rules for use and payment of electricity from the power plant, appliances in the houses, spare parts, distilled water for batteries and local institutions involved in the collection of revenue, etc. (Ulsrud et al. 2011:4). This configuration of social and technical elements makes it useful to see the cases as socio-technical systems. But as we will be analyzing the processes as a set of trust relations, we must start by asking; is it meaningful to see technology as part of a trust relation?

It can seem intuitive that trust must be vested in people, rather than natural objects or events (Sztompka 1999:19). In the three-part formula of trust (A trusts B to do x – or with respect to x), the final clause of "x" is also frequently omitted, even though the limitation to certain areas – its *conditionality* and *specificity* – are apparent in virtually all cases of trust (Hardin 1999:26). One reason might be that the "x" often refers to something either very specific, like an object such as a banknote or a watch, which will remain the same if nobody damages it. However, to forget the "x" is to neglect

one important fact: some objects, like technological components, can change over time, either without individuals involved or as a direct result of an individual's actions. Trust in technology is, in the final analysis, vested in the trust of those who design, operate and supervise the technology (Sztompka 1999:46).

Accounting for technology is important. But for the cases on the Western side of Sunderbans, more is needed, as we also need to understand why the situations have changed over time. To improve our theoretical thinking regarding both commons and social dilemmas, a better understanding of change is called for by Poteete, Janssen and Ostrom (2010:244), and Rothstein (2005:7), respectively. Systems may change or evolve over time due to a magnitude of predictable and unpredictable factors, such as technological development, changing norms or knowledge, change in political regime, governance, policy or unforeseen events such as fires or disease outbreaks (Poteete et al. 2010:244). Such changes are important, as the transition from an "efficient" to an "inefficient" equilibrium can occur with, in the words of Rothstein, "a catastrophic logic" (2005:21). Even though we have excellent models for explaining static situations and trusting cooperation over time, we still lack useful models to explain why a situation changes from one state of affairs to another (Rothstein 2005:7).

As such changes can occur in many forms, understanding them should be tied to their context. In this case, we need to explain how change can influence a socio-technical system. *Theories on socio-technical systems* may aid us in this. These are theories emphasizing the importance of seeing social and economic organization as tied to technical configurations. Technology should be analyzed as part of a "social fabric" – with a texture incorporating social practices, competencies, meanings, values, institutional settings and other elements. Technology is seen here as *socially embedded* through a dynamic process of social learning and mutual adaptation (Ulsrud et al. 2011:2, 4). Theories on socio-technical systems encompass a broad range of approaches, such as *science, technology and society* (STS), *social shaping of technology* (SST), *constructive technology assessment* (CTA), and *practice theory.*

Early literature on socio-technical systems focused on the design phase of technology, while focus is now on the social shaping of technology. The theories want to explore how social choices are always involved in technological change (Rohracher 2003:177). The aim is to facilitate social learning on implementation and operation of technology by increasing our understanding of *processes* that embed technologies in

social life (Ulsrud et al. 2011:2). All phases are taken into consideration – from implementation and installation to organization and changes underway.

Technology and behavior have often been studied in isolation, but it has been argued that it is crucial to understand the relationship between technology and behavior (Wilhite 2008:121). Users are therefore given an important role in these perspectives (Schot 2001:40, Douthwaite et al. 2001:821, Ornetzeder and Rohracher 2006:139-146, Shove 2003:202-203), and there has been a call for a need to develop a broader understanding of users and their needs (Rohracher 2003:178). Theories on socio-technical systems offer us a perspective, rather than a uniform theory, on change. By employing this perspective, we are better equipped to analyze the complexity of social interaction within socio-technical systems over time, by emphasizing the social and technical elements as inter-related and steadily changing processes.

Although these theories emphasize the mutability of the social and physical world, they also acknowledge the limitation of this mutability. Neither the social world nor technology can simply be shaped as we want, and we are often unaware of the ways such processes affect us. One branch of theories of socio-technical systems, called *practice theory*, seeks to explain the durability of social structures by describing how social actions are embedded in physical objects.

Elements of this theory can be found in the work of scholars such as Pierre Bourdieu ('praxeology'), Anthony Giddens, (theory of structuration), Foucault (analysis of relationships between bodies, agencies, knowledge and understanding) and Bruno Latour (science studies) – theories described as part of the "praxeological family of theories'"(Reckwitz 2002:243-244). With its focus on body, mind, things, knowledge, discourse, structure/process and the agent, practice theory differs from both traditional culturalist and social theories (Reckwitz 2002:245).

Practice theory aims to do something similar to what Ostrom does when criticizing Hardin's theory: to revise the hyper-rationalized, intellectual picture of human behavior often presented in scholarly literature. Practice theory replaces the academic vocabulary of mind, texts and conversation with ideas about physical actions, practical knowledge and routines (Reckwitz 2002:259). Human rationality is seen as *embedded* in mental routines of understanding and knowing (Reckwitz 2002:258), calling for a focus on practices – or physical actions – because learning a social practice is "to learn to be bodies in a certain way" (Reckwitz 2002:251). In this perspective,

"users are continually making and remaking ideas and visions of normal society through their routinized actions and practices" (Shove 2003:203). The use of technology and processes of invention usually involves a redefinition of "normality" (Shove 2003:202), while everyday life is seen as a fundamental concept to understand the nature of modern technology. This is because users do not passively adapt to technology– technology adapts to every day life and vice versa (Shove 2003:203, Faulkner 1998:405, Wilhite 2008:121,129).

By focusing on concepts of everyday life, this perspective sees consumption as something people do because it has grown to be part of their everyday lives, not because they enjoy the consumption in itself. People consume because they desire the qualities of *comfort, cleanliness* and *convenience* that come with it, which over time becomes embedded in their social practices (Shove 2003:195).

We consume resources because of socially informed "needs," which are likely to change over time. One example is the introduction of the freezer in the United Kingdom, originally introduced as a way to "beat the seasons." However, it soon became a life-style transforming technology – a "time machine," allowing people to reschedule and reduce the time spent shopping and cooking. Eventually, people increasingly felt they "needed" the freezer to carry on with their new routines and practices. While only three per cent of the population in the UK owned a freezer in the 1970s, the number had risen to 96 per cent by 1995 (Shove 2003:195, 201).

4.6 From theories to reality

What are the implications of these theories for our cases? In the preceding chapter we learned that analyzing the Sunderban cases merely as cases of common resources does not account for the variations found in the situations. The social processes of the commons should therefore be analyzed separately from its effect on the outcome. Trust has been introduced as an analytic concept that can account for the complexity of social actions, both the moral and utilitarian component of human behavior, and the way it can interact with various forms of institutional design. As the cases we are analyzing involve technological elements, and because changes in the situation over time needs to be accounted for, process-based perspectives derived from theories on socio-technical systems will supplement the theories of trust. With that, we leave the world of scholars

to see if reality echoes the world of theories. But first, we need to know how to approach this reality.

5 Method

How can we explain why people choose to cooperate in some instances and not in others, or why individuals sometimes comply with rules and ignore them at other times? A mere mapping of the extent of electricity overuse would not answer the question. It might be useful to establish a profile on the socio-economic characteristics of the inhabitants like, for instance, to analyze whether such characteristics are correlated with tendencies to over use. But such an approach would only map one variable, and would not account for the nuances in an individual's thinking.

The researcher should always strive for tailoring his or her approach, by asking: which method will be best suited to answer the research question? (Silverman 2010:9-13). If we want to ensure that the variations in compliance are properly understood, we must leave our minds open to the idea that a range of variables may have caused these differences. This makes qualitative methods well suited to answering the research question. Qualitative methods are *content seeking* in their aim to clarify the characteristics of a phenomenon (Widerberg 2005:15). They are characterized by inductive approaches to phenomenon, favoring exploration of several variables rather than testing a specific theory or hypothesis, and emphasizing understanding, proximity, and an open interaction between researcher and informant (Tjora 2010:4).

One of the advantages of qualitative methods is that they are characterized by empathy and creativity (Widerberg 2005:29, Tjora 2010:4), but also systematization**.** While empathy is important in understanding a research object's life circumstances, systematization in qualitative methods refers to the importance of careful consideration of data and a reflection on important decisions that the researcher makes during the research process (Thagaard 2003:14).

The interaction between creativity and systematization can be driven from both empirical data or theory or an inter-play between these two (Tjora 2010:4-5). Even though a proximity to the people being studied is one of the strengths of qualitative methods, this proximity also presents its greatest challenges. The relation between researcher and informant in the field can impact the quality of the data. Such challenges are related to the researcher's approach, interpretation during and after fieldwork, the

way data is stored and analyzed, and ethical issues (Thagaard 2003:13-14). No blueprint approach to handle such issues exist, and it is therefore important that the researcher presents all the relevant aspects of the fieldwork, and reflects upon and is open to choices made before, during and after research is carried out. Presenting these reflections is the goal of the remainder of this chapter.

5.1 A multiple case study

To answer the research question, the case study method was chosen. The case study method is one of many qualitative methods, and is especially useful when trying to make sense of complex processes. A case study uses insights from one or more cases to draw insights about a broader number of cases (Poteete et al. 2010:33, Yin 2003:16), and has been widely employed to study common resource situations. Case studies are one of the many methods to aid scholars, officials and citizens in understanding a *potential* set of variables that can be important in analyzing the governance of resources (Poteete et al. 2010: 234-236).

The number of cases chosen and the choice of methods to approach the case study have been tailored to the resources available. Methods should be chosen on the basis of the research question, the time and financial resources required, access and availability to data, as well as the focus of the topic (Silverman 2010:9-13). The time and energy required to collect the data depend greatly on the existence and accessibility of previously collected data and the ease of collecting original data when necessary (Poteete et al. 2010:37).

An advantage of choosing the solar mini-grids at the Sunderbans as my cases was the access to extensive earlier research on the topic. This provided valuable information on the case background and earlier experiences, enabling me to instead use my time in the field to focus on my research question. Within a case study, I could have chosen various qualitative methods, such as interview, observation or analysis of documents and pictures (Thagaard 2002:12)**.**

The choice fell on interviews, for pragmatic reasons. The scope for doing observation was fairly low, because of practical limitations such as where I could live, access to clean drinking water, safe food and so on. In addition, I would never have been able to “blend in” during such a short time period, as the Sunderbanis rarely saw

Western people like myself. Language was naturally also a problem. The villagers of the Sunderban Islands have a low English fluency, speaking native Bengali in their daily lives, making it impossible for me to comprehend the flow of routine conversations. However, conducting interviews was possible with an interpreter.

Interviews were suitable for this research project because I wanted to find out why people *chose* to act as they did. Interviews give us the opportunity to trace understandings, not only facts. They are a way to access the informants' understanding of and reflection on their own life situations (Widerberg 2005:58). As argued by the Weber-understanding (Verstehen), social scientists should be attentive to understanding subjects at their own premises when approaching a field. Actors always behave "rationally" in relation to the situation they find themselves in, and the scientist should therefore always aim to understand their actions in their natural environments (Lysgaard 2001:20).

The Sunderban cases can be seen as a suitable "theoretical sample" of common resources, with potential to shed light on theories in the field. Common resource literature is a field of complexity, with newer contributions in the field calling for theories that allow for such complexity. These cases are important, because their variations challenge the theories' ability to provide full explanations, and may shed light on factors that can have relevance for other cases.

In addition, the cases have the advantage of clear boundaries and clear identification of users, compared to several other cases of common resources. The difficulty of studying common resources is often that the boundaries and users of the resource are hard to identify, such as a river that runs through different villages, cities or countries (Ostrom et al. 1999:278). The advantage of the socio-technical system of the solar mini-grids is its easily identified users, having specific rules for property and access. This is an advantage, but not enough in itself, as the way the analysis is done is equally important in generalizing to other cases, or to a theory.

Qualitative data, such as data from case studies, opens up the possibility of doing *conceptual generalization.* Conceptual – or analytic – generalization implies that the researcher can develop concepts, typologies and theories from the findings of the cases that can have relevance for other cases (Tjora 2010:117). This form of generalization has the potential to lift our gaze from the specific cases, by asking what this is a case of, or what is this phenomenon about? For instance, can the researcher explore whether

certain concepts exist that will capture central characteristics with observations and findings (Tjora 2010:125).

One form of analytic generalization has already been discussed in chapter three, with the review of Hardin's theory, where it was found that Hardin had identified the characteristics of the *commons* – in the form of an open access communal management system – as the most important characteristic of his case study. As the discussion on Hardin revealed, analytic generalization to other cases cannot be applied uncritically, as it requires that all the relevant characteristics of the cases are accounted for.

5.2 In the field

I stayed in India for the purpose of this thesis from July to September 2011. Interviews were conducted in Kolkata and the Sunderbans in August 2011, leaving additional time open at the end of the stay for any fieldwork delays. Fieldwork was carried out during monsoon time, having both advantages and disadvantages for data gathering. Monsoon season is the most stressful time of year for the villagers on the Sunderbans, and the frequent operation and electricity use can strain the battery banks more than other times of year. Heavy rainfall and cloudy days make the solar mini-grids unable to supply the same amount of electricity during monsoon than other times of the year, imposing limits on supply to customers. Because monsoon time is a critical time of year, it is useful to study the challenges monsoon time imposes on the supply system. However, the problem with conducting fieldwork during monsoon time is the potential interruption by flooding, difficulties with traveling, and ensuring safe sanitation conditions. To some extent, all these problems were faced during fieldwork, but due to allowing sufficient time for flexibility in traveling, and also partly due to pure luck, these challenges did not hinder data gathering.

The majority of the interviews were carried out with an interpreter, translating from English to Bengali and back. Four interviews were carried out without a translator, as some informants had a sufficient English vocabulary. As I wanted to understand variations in compliance within the cases of socio-technical systems, I needed to know how people in different roles of the chain understood their own situations.

5.2.1 Sample

This implied interviewing those using the system (customers), those maintaining and operating the system (operators and linemen), those monitoring the use of the system (customer representatives), and representatives of the institutions initiating and following up on the mini-grids (WBREDA, WWF, contractors). The informants were chosen to reflect a representative sample of these roles. Thirty-four interviews were conducted, consisting of sixteen customers, six operators, one lineman, seven customer committee members, one member of the Sagar electrification committee, one contractor, two WBREDA officials and one WWF employee.

All the operators were interviewed due to their important role in the chain. The customers and members of customer committees were chosen based on characteristics such as gender, age and socio-economic status. Their age ranged from 24-70, occupations included day laborers, farmers and schoolteachers, and the subjects lived in both mud houses and brick houses (indications of wealth). Of the two WBREDA officials, one was working in the Kolkata office and one in the Sunderbans. At WWF, I interviewed the employee who had worked most extensively on their solar mini-grid project in Satjelia. The contractor interviewed had an ongoing contract with WBREDA on Sagar Island since the first power plants were installed in 1996.

In the thesis, the informants' are given fictitious names. Informants are named after their social role: operators' names start with O's, customers' names with C's, Beneficiary Committee members with B's, WBREDA officials with W's, while the contractor and WWF employee are simply named "contractor" and "WWF". Appendix 1 gives an overview of their island affiliation. Although the six villages in the islands have been identified by name (see Appendix 3), it is not stated which village the informants are from, to ensure anonymity, as the operators easily could be identified if the names of the villages were given. The exception is Satjelia, as only one solar mini-grid was visited here, making one person – the operator – recognizable. Yet, the information he provided has not been considered as sensitive, and such information would have been omitted if that was the case.

5.2.2 Conducting interviews

Thirty interviews were conducted in Sunderbans, and the remaining four interviews in Kolkata. The interviews' length was not pre-decided, but ranged from twenty minutes to four hours. The average length was one-and-a-half hours, and all interviews received the required time. I used an interpreter, Krishnapada Sasmal (Krishna), who was with me for most interviews. He had worked on other research projects in the past, and was a fluent English speaker, as well as fluent in the local dialect of the Sunderban area.

My stays in the villages always started with interviewing the operator of the plant. This enabled an overview of the current functioning of the plant and distribution line before interviewing the other informants. In the Sunderbans, requests for interviews were carried out by my interpreter on-site, by approaching people in their homes. Everyone was surprisingly willing to talk, probably partly due to the importance of electricity supply for them in general, but presumably my "otherness" as a foreigner was also an advantage. In addition, the hospitality of the Bengali people may also have contributed to their openness, considering that being a foreigner in another setting or country could have backfired and proved a disadvantage.

The informants usually invited me and Krishna into their homes. Before the interview started, the informant was presented with an introduction of the project (see Appendix 2). We emphasized that participation was voluntary, and informants were asked to give their consent to a tape recording. Before we started, I made it clear that I was not working for any organization, company or state agency, but only as an independent researcher.

I followed a semi-structured interview guide starting out with some neutral questions and eventually moving on to potentially more emotionally charged issues, following the example of Karin Widerberg (2005). I always ended the interviews in the same manner, by asking about the informants' lives, dreams and hopes for their children (if they had any). The questions were formulated with the intention of not being too general, but rather explorative. I aimed to avoid formulations that could be leading, and formulated questions in ways like "Tell me about…?", "Can you say more about…?", "How did you experience…?".

My intention was originally to record all the interviews. However, some of the informants at the Sunderbans declined this request, and I noticed that many looked with

skepticism at the recorder. Advanced electronic devices are not common on the islands, and the last thing I wanted was to create a distance between us. I had discovered that when I at other times raised my camera, people would immediately become more aware of the "otherness" of my world as a foreigner. After experiencing suspicion towards the recorder on occasion, I decided to stop using it. I had discovered that using an interpreter allowed me time to take in-depth notes during the interviews, making it possible for me not to need a recorder.

Private space is difficult to find in India, with small houses, large families and tight family bonds. Even though only one informant is listed per interview, there were often several people present, and these people sometimes intervened and added information or comments. Some interviews were carried out with only the interview object present, while one interview was conducted with twelve family members sitting around. However, most of the interviews were carried out with one or two other people present, most often the spouse.

I would not label these as group interviews, since I always made it clear in advance which person of the household I was carrying out the interview with, and both my and my interpreter's attention was continually directed towards this person during the interview. However, if the informant was not sure what to answer due, for example, to a lack of knowledge on the subject, other people in the room would often add details. Despite this lack of privacy, these interviews all worked satisfactorily. The main attention was kept on the interview subject, while others could add useful information. Interviewing with other people present might have influenced the answers, but the type of answers I received during one-on-one interviews, compared to those times when other people were present, were quite similar. This suggests that lack of privacy was not as problematic as it might have been if I was studying more sensitive issues.

It was also insightful to witness the dynamics between the people. At Sagar and Moushuni, interviews could sometimes lead to discussions between the people present, for instance over details about the electricity supply, as they had differing degrees of knowledge. These discussions underlined the lack of clarity and information that existed in the supply chain, offering me important information.

After having carried out some interviews, I started to discover gender-related patterns with respect to knowledge about the supply system. Originally, I had intended to interview an equal number of men and women. However, I started reconsidering this

decision after discovering that women had a limited knowledge of the topics about which I wished to inquire.

An incident in one household is illustrative of this: I was supposed to interview the woman of the household, and her husband was sitting politely quiet next to her on the floor. However, it turned out that the woman could not answer most of the questions I posed to her. In the end, the interview turned out to be with her husband, as he could readily give extensive answers to every question.

I experienced similar situations, and interpreted the inability by women to provide answers other than "I do not know" or "My husband takes care of these matters," as a genuine lack of knowledge on the subject, not as a result of gender roles. The women on the Sunderbans appear strong and independent, and showed that they were not afraid to speak up, voice opinions or shout if they wished to, even with men present. In interviews where men were the main informant, women would regularly join in with comments as about their dreams and hopes for their children, or describe the appliances they dreamt of using if they had access to more electricity.

However, because of these experiences with women being unable answer my questions, I decided to under-sample women in the customer interviews. This resulted in only 1/5th of the customer interviews being conducted mainly with women, although women were present and contributed in virtually all interviews. In actual practice then, men gave me information on customer agreements, meetings, sanctions and overuse, and women generally would supplement other questions. In retrospect, I realize it would have been interesting to study in more depth the gendered differences in knowledge and use of electricity, although it probably would have required another research design.

5.3 The researcher effect

The scientist will never be able, no matter how well prepared he or she is for an interview, to avoid partaking in a relationship with the informant. One can never be sure what will happen during an interview, and the researcher can therefore never be fully prepared (Neumann & Neumann 2012:11-12). Scientific work is weakened if the scientist is unable or unwilling to account for how he or she might have affected the

field. Due to this, the reader should be given information on the conditions in which the data was gathered (Neumann &Neumann 2012:13-14).

By being open about the ways we practice our research and account for the choices we make can only strengthen the validity of the research (Tjora 2010:116). This is essential to acknowledge, as the scientist will always be situated in a specific way within a field, and in social science we can speak of three ways that the researcher can situate himself or herself: in the field, self-biographically and by text (Neumann & Neumann 2012:17). All three of these orientations have influenced this thesis in different ways.

5.3.1 The researcher's effect on the field

During interviews or observation, our perceptions of the people in the field and their perceptions of us will influence what people do, what they talk about, how they talk about it and how much they are willing to talk about it. The researcher's situation in the field is about how others' experiences of the scientist affect the result of the research (Neumann &Neumann 2012:17-18).

As a young, white female from one of the richest countries in the world, doing research in a poor and remote part of the world, my presence obviously had an influence on the field. I did not "blend in." People were staring, smiling, laughing and pointing when I traveled past them. Yet, this was only from a distance. If they sat next to me on a crowded cycle van or on a ferry over tidal rivers, they were quietly there beside me, treating me as one of their own, even calling me "sister" on some occasions. During my stays at the islands, in general, and at the interviews in particular, I *felt* accepted.

It is my belief that I can attribute much of this to Krishna. Krishna did not only bridge the language gap, he was also a door opener to the field. Krishna spoke the local dialect, and he approached the informants by greeting them with the Bengali words for "uncle" and "auntie," making the interview atmosphere more relaxing and comfortable.

My informants in Kolkata probably interpreted my appearance in a different way than the Sunderban customers. I interviewed middle-aged men in state agencies and private firms who were very busy and attended to many people. I was a girl probably half their age, doing interviews in a "man's world," dependent on them to speak with me, while they were not obligated to me in any way. These factors probably affected the

dynamic between us in the interview setting. Although the interview appointments were always pre-scheduled, I was left waiting for long hours in the offices. On one occasion I waited three hours, only to be sent home with a message to come back the next day.

On some occasions I felt the power relationship more explicitly, for instance when one informant asked me to repeat my name at the end of the interview, followed by the reply: "I thought your name was Barbie, because you look like Barbie." I was quite taken aback at this statement, as I had never assumed short, brown hair would be associated with a Barbie doll. During all interviews, and generally in all settings in India, I took care to dress as appropriately and neutrally as possible, wearing loose-fitting clothes, long sleeves and minimal make-up. The Barbie comment was something I therefore later interpreted as a "power play," a sort of power affirming statement. However, the incident made me more aware of how delicate the balance between researcher and informant can be.

Using an interpreter always involves a risk. The potential for misunderstandings in the communication increases, and the researcher cannot control the information like he or she can in other settings. The interpreter should therefore also be aware of some basic facts of what characterizes good research, in addition to the importance of good communication between the researcher and interpreter. I felt fortunate to have Krishna as my interpreter, and I believe he was a decisive factor in gathering useful data. He helped me in practical matters such as finding lodging, accessing safe food, and securing clean water and sanitary conditions, all of which would have been highly challenging without him. Spontaneous statements from Krishna, such as "The translator should copy the meaning of the sentence perfectly: he shall not exclude anything, and add nothing," ensured me that he understood some of the basic characteristics of research.

If Krishna at some point did not fully understand the question I wanted to ask during interviews, he asked me to explain it in another way, to make sure he asked the question as I had intended. When Krishna's assistant replaced Krishna in his absence for two days in the field, the importance of a good interpreter grew even clearer to me. His assistant's English vocabulary was limited, and he did not understand my 'non-Indian' English accent well at all. I did not get the rich data I wanted during those days, and I therefore had to take extra care to be sure I did no misinterpret that data.

5.3.2 The field's effect on the researcher

As researchers, we are also influenced self-biographically. The researcher's own story is decisive in choosing the subject for the research and the approach the researcher takes (Neumann and Neumann 2012:19). This thesis is no exception. Both personally and academically, I am concerned about the need to distribute the world's resources equally among people and finding ways to prevent climate change. This is the reason why I entered this field. Some might regard this as a normative reason, yet one can argue that the researcher will always have a motivation for entering a field, making the need to acknowledge it even greater.

Several things have been essential for my understanding of the field, and have shaped my perception of it. I was aware that my knowledge of the field was limited, and attended a summer course in Bengaluru in July 2011 before my fieldwork. The purpose was to gain insights on environmental, political and cultural issues in India, and ease the transition to fieldwork. Despite this being a useful preparation, the experiences I had during fieldwork were much more decisive in my interpretation and understanding of the field.

I took notes constantly about both the field and how I experienced it. The notes from before, during and preceding fieldwork provided valuable information at the later stages of writing the thesis. They reminded me of my preliminary assumptions and thoughts, and confirmed for me the value of interviewing people *where they are*, as opposed to employing documents or interviewing by e-mail. My experience was that being in the field was critical to how I looked at my informants, as my understanding of the circumstances they were in changed from the time before I left home to the time after I had completed my fieldwork. Having a physical experience of the "light version" of the Sunderbani's everyday lives changed my perceptions and enriched my understandings of their lives.

To experience what daily life was like without electricity, or with the restriction of it, made me realize the importance of electricity in ordinary activities I normally take for granted. Experiencing the humidity, flooding and the nights without fans to mitigate the heat, getting bruised by bumping along largely devastated brick roads on auto-rickshaws, walking around at nighttime knowing there was always a risk of tigers and poisonous snakes was inconvenient and even frightening. But more critically, people

would die on the way to hospitals, as infrastructure was poor and the lack of 24-hour electricity made it impossible to keep the needed antivenim in refrigerators.

These experiences changed me. Before I left for India, I would more easily have accepted Hardin's explanation, seeing customers as examples of one-dimensional, ego-centered people, and blame the situation on our human desire to consume more and more. Hardin could confidently argue as he did, as he had never met the 18th century herdsmen whose behavior he sought to explain. When I returned to Norway, two important insights had emerged: these people *need* electricity, because they need development. And, for them to go back to a world without a service they needed so desperately would be very difficult.

These realizations caused me to strongly agree with the following words from the sociologist Vilhelm Aubert, who described living among research study subjects "as a counterweight to the dominating influence the university and research institute's social atmosphere has on the students' and researchers' understanding of the social reality" (Aubert 1969:197). To this, I would personally like to add that living among data subjects in another part of the world is in itself a counterweight. It is a valuable counterweight to our Western understandings of rationality, individual choices and interaction with institutions. Exposing ourselves to the world outside of Norway has potential for enriching our sociological understandings.

5.3.3 The process of writing

"Text situation" can best be understood by understanding how being situated is always related to *something.* While self-biographical situation relates to the researcher, text situation implies that a research process and the process of *writing* science will always impact the text. The writer learns from and is changed by the writing process, and the text will be shaped by how its writer changed and how the writer relates the text to the world (Neumann & Neumann 2012:19-20).

We can be situated in our personal style of writing, in the writing style of our discipline or the national scientific writing style (Neumann and Neumann 2012:97-100). Writing the material in different ways, weighing the relevance of the content in different ways, and witnessing the changes that occur when data interacts with, encounters and

rubs against theory, has been an essential part of the analysis – and fascinating for the novice researcher.

In retrospect, I see the challenge of finding the right form of expression as one of the most decisive. The writing was undertaken in several rounds, with style changes along the way. Writing in a language I was unfamiliar with, being unable to find the right words at the beginning was one barrier. Allowing myself to break with the informants' style of presentation and letting their accounts interact with the theory was another. But also finding the right *style* of writing, that would allow me the right form of presentation, was challenging.

Usually employing the impersonal style of scientific writing, I found that this hindered my writing and clouded my thinking in this specific case. I knew that my encounter with the field, including both the personal and disciplinary background that shaped my encounters, had influenced the way I had interpreted and presented my data. Eventually I understood that I had to make this clearer in the text, by emphasizing the "I" as a researcher, as well as making sure that the voices of informants stood out loader and clearer.

My problems with finding "the right voice: resonate with Iver B. Neumann's (Neumann and Neumann 2012:98-100) experience of being shaped and torn between the different styles of writing of anthropology and political science. Presenting forms of organization in a neutral way, providing descriptions of an unfamiliar world, and at the same time keeping it within a sociological frame has been challenging. So I can conclude that the process of writing has also shaped the presentation of findings in the thesis.

5.4 Data analysis

The decision on the scope of the cases resembles the decision of choice of methods. The choice should not be seen as a decision between words and numbers, or precise and imprecise data. Instead, we are choosing between a range of precision, and our choice of level of preciseness should depend on the nature of what we are trying to describe (Silverman 2010:14). This choice is important, as the data material itself is a result of the continual analyses and choices before and after the data gathering (Widerberg 2005:116), implying that the analysis had started already with the choice of cases and research questions.

The data analysis has been completed in several rounds –from reviewing preliminary field notes and exploring varying thoughts about possible correlations to how to structure main "findings" after my arrival back home and pouring over the data material in various rounds, before, during and after I had familiarized with the theory. Here, we find a delicate balance, between the importance of starting analysis in an early phase to avoid being too influenced by theory, and the importance of continually keeping a critical stance towards my own data material, not jumping to conclusions (Silverman 2010:40). As already mentioned, there is no blue print for qualitative methods in general, and particularly not for data analysis. The process often includes phases like categorizations, discussions of concepts, processing raw data and developing concepts, and not necessarily in a linear process (Tjora 2010:102-103).

Throughout the process, I have attempted to pursue a critical perspective towards tendencies in the data material, by aiming to balance emerging patterns against accounting for deviant cases or conflicting perspectives between informants. However, doing qualitative research always involves interpretation. This can be illustrated by, for instance, in how some questions are impossible to ask informants in a straightforward way. If I were to ask the informants, "Do you overuse"?, they would probably reply negatively and be unwilling to give me extensive answers. By using more indirect questions, like questions concerning characteristics of the supply chain or about the actions of customers in general, more extensive answers can be offered, but again this implies that I have to interpret the answers given to me to some extent. In addition, a comparison of data against theoretical frameworks will always involve interpretation – of the data, theory and how these should be seen compared to each other.

In other words, there is no escaping theory. We need the theoretical lens to see the world more clearly, but choosing one theoretical perspective always implies *not* choosing others. In any research setting, there are multiple phenomena available (Silverman 2010:51). This has grown clear to me through the analytical process, especially by discovering the theoretical shortcomings of the field of the commons. In a way, we can say that the choice of theory directs our camera lens – the lens we view the world through – towards one specific object.

My sociological training enabled me to use a wide-angle lens, zooming in and out on different levels, deciding the aperture on the basis of which aspects I wanted to emphasize. But the frame – the lens that I have attached to my camera in this situation –

is fixed. The implication of this is that the findings of this thesis might have turned out differently if other theoretical perspectives had been employed. Because of the limitations of disciplinary perspectives and choice of theory, it is my belief that the thesis has benefited from the inter-disciplinary environment in which I have written this thesis. I had both a sociologist and a human geographer as supervisors, and I spent my days writing in the multi-disciplinary environment of the Centre for Development and Environment. For me, there is no doubt that this has improved the final product by increasing my awareness of the nature, benefits and shortcomings of my own approach.

5.5 Ethics

The purpose of the study was to do a micro-situated analysis, understanding the situation of the villagers from their perspective. To better grasp the informants' social role – a potential contributor in shaping peoples' actions, motivation and interest, and also their propensity to trust – I collected data about the informants' ages, occupations and marital statuses As I gathered data that could identify the informants, I applied and was granted permission from NSD (Norwegian Social Science Data Services) to carry out the project. The notes and recordings from the interviews were kept safe by always ensuring that my notebooks and computer were kept with me, or in a safe place. The information about personal identification marks was coded when I recorded or transferred it in other places, such as on documents on the computer.

The professional ethical guiding rules for scientists tell us little about the impact and importance of what the researcher does and brings into the field. They do not say how the scientist should handle the emotional attachments he or she has to the field, or to individuals encountered, in an ethical and responsible way (Neumann and Neumann 2012:15). This was admittedly a challenge in a context like the Sunderbans. As a Norwegian researcher, I was in a highly privileged position compared to the villagers, and by inviting me into their homes, accepting the role of informants and offering me tea and biscuits, it was they who were giving me – the privileged one – something valuable. Two things were important for me in these situations: not raising their hopes in terms of what I could do for them, and being able to give something in return.

When describing the intention of the study to informants, I took care to do it in a way that did not raise their hopes in terms of what I, or my research, could do for them. I

said that it might help them, it might help others, but I could offer no guarantee if or how it would. As I felt that I should give something in return, I gave the informants' the chance to ask me questions if they had any at the end of every interview. This was intended as a way of giving something back, and it turned out that both the informants and I seemed to appreciate this informal aspect of the interview exchange. In such cases, we would often sit together and drink the traditional tea with buffalo milk and an excess of sugar, and talk about our respective families and lives, the midnight sun, or the vegetables we grow in Norway.

5.6 Validity and reliability

Regardless of method, data will never *be* reality, and can never represent "the truth." Instead, data represents specific extracts, depending on the research question and the researcher's preconception and perception on relevance (Johannessen, Tufte and Veiden 2006:54-55). These aspects have already been accounted for above. However, with respect to the validity and reliability of research, in terms of, for instance, analytic generalizations of the findings, the data's representativeness is essential to emphasize and critical to examine.

A challenge with case studies is that they can be difficult to replicate. Also, no single case study is conclusive, but instead should be seen as one piece in a larger puzzle. One of the limitations with case studies is that a case can never represent the broader population, and therefore lacks external validity. Through Garrett Hardin's theory, we have already seen the danger of generalizing from one case to others. Expected limitations in generalizing social patterns from case study to case study include intentionality, adaptation, strategic interactions and path dependency (Poteete et al. 2010:33-36).

Case study research *can* contribute to theory testing, but synthesizing the findings represents a considerable challenge. If case studies are to be used for theory building, it depends on the scholar's abilities to overcome the barriers that arise from disciplinary perspectives, methods and boundaries (Poteete et al. 2010:33-35, 39). These challenges underline the importance in this study to be careful claiming any generalized findings. The Sunderban cases might be seen as cases of common resource management, but because of the problems with characteristics of the commons already

discussed, it is rather the mechanisms found within the cases, rather than their outcomes, that should be generalized. One could add that the use of trust as the conceptual tool can, due to its universal meaning, have potential for the analytical generalization of cases. We will explore further whether trust is a useful tool of analysis in the following chapters.

6 The Western Sunderbans

West Bengal, August 2011: Five hours away from the Sunderbans, in a Kolkata office, with project documents piled up on his desk, Waahid, one of the WBREDA officials working most extensively with the solar mini-grids, describes the current situation at Sagar and Moushuni with an analogy:

> Once there was a king who told some of his workers to dig a pond. Once the pond was dug, the king made an announcement to his people saying that one person from each household has to bring a glass of milk during the night and pour it into the pond. So, the pond should be full of milk by the morning. After receiving the order, everyone went home. One man prepared to take the milk during the night. He thought that since everyone will bring milk, he could just hide a glass of water and pour it into the pond. Because it will be dark at night, no one will notice. So he quickly went and poured the water in the pond and returned home. In the morning, the king went to visit the pond and to his surprise the pond was filled only with water! What had happened was that everyone thought, "I don't have to pour in milk, someone else will do it.
>
> ("A Pond Full of Milk", Author Unknown)

The story of "A Pond Full of Milk" is commonly known in West Bengal, and can be seen as a variant of the social dilemma. Interestingly, Waahid did not explain the social dilemma at the Sunderbans as a "free-rider problem" or "tragedy of the commons," but instead focused on the challenge of inducing people to behave in a desired manner. While scholars have dominated the conversation until now, it is time to turn to the accounts of the Sunderbani people, and discuss whether reality will align with the world of theories.

6.1 Solar mini-grids at Sagar and Moushuni

Waahid and the other officials in WBREDA have installed seventeen solar mini-grids in the Sunderbans. Ten are located in Sagar Island and two in Moushuni Island (Ulsrud et al. 2011:5). The power plant's capacities ranges from 26-120 kW, and are operated by an employee living at the power plant. Electrical power supply is turned on by the plant's operator at nightfall (6 PM), delivering five hours of daily electricity at optimal

conditions. The customers can choose either a 3-point (max 70 W) or a 5-point (max 120 W) connection**,** and to obtain an electrical service connection, they pay a thousand or fifteen hundred rupees, respectively. Monthly fees are based on flat rates: customers with 3-point connections pay 80 rupees (1,5 USD) while 135 rupees (2,6 USD) are required for 5-point connections (Ulsrud et al in progress).

When WBREDAs former director, Gon Choudhury, installed the mini-grids, the state agency was highly innovative compared to similar development projects in terms of participatory community management. Actors on all political levels have participated in the process, from the national government and the state of West Bengal to the Zila Parishad, the block level and the Gram Panchayats. The mini-grids are funded by the National Government, the India Renewable Energy Agency and the World Bank, with WBREDA as primarily responsible for implementation and operation. WBREDA has secured funding, identified villages, contacted local authorities and had responsibility for battery replacement and other major improvements.

Before the power plants were implemented, WBREDA held meetings with local leaders, teachers and other central figures. Together, the villagers and WBREDA made the decision on where the mini-grids should be located and decided on the organizational details related to electrical power supply. The local government allocated government land and partly financed the distribution lines at the plants. Informational meetings were held for the local people, and in a few cases, surveys were conducted to evaluate potential demand. Through bidding rounds, supplier companies were chosen, and given responsibility for overseeing operation and general maintenance of the plants. These are referred to as contractors by the customers. It is the contractors' responsibility to provide trained personal, ensure good performance at the plant and to supervise operators (Ulsrud et al. 2011:5-6).

The villagers have been given responsibility for the day –to-day operation, and the central actors involve operators, money collectors, linemen and Beneficiary Committees. Each of the power plants has one or two operators (in most cases one) who are responsible for turning on and off the power supply, keep records, as well as perform general maintenance. The operators are either trained personnel brought from the outside or local individuals who have received training on-site.
In addition to the operators, local people are employed to monitor consumer compliance. Money collectors handle monthly fees, while linemen walk the streets at

night to monitor consumption and disconnect households for non-compliance (Ojas) or unregulated behavior (Ulsrud et al. 2011:8-9).

Local customer committees – Beneficiary Committees (BCs) – have also been created in each village with responsibility for collecting fees and enforcing proper use. Proper use involves, for instance, that the right type of appliances are used and the power load is not exceeding the amount allowed. Members of the committees are volunteers; they do not receive any form of financial compensation. Their job is to both control and represent, by monitoring customers' consumption and protecting customer interests (Ulsrud et al. 2011:5-6).

WBREDA's solar mini-grid cases have been championed as rural electrification success stories. The mini-grids at Sagar have received particular praise in the academic literature, and have been cited as evidence that income can be generated while providing high quality and reliable energy (Shrank 2008:9-10, Chakrabarti and Chakrabarti 2002:38-40). The islands' community management system has been described as a successful example of community participation and good governance (Gulati and Rao 2007:129). While electricity theft is a growing problem worldwide and the situation in many African and South Asian countries is particularly worrisome (Winther 2012:11), the community management system at the Sunderbans has been successful in overcoming the common problem of non-collection of tariffs (Shrank 2008:7). For India in general, it is estimated that 20-25 per cent of revenues from the electricity sector are disappearing due to theft, leaving yearly losses from theft at over one per cent of the country's gross domestic product (Winther 2012:11). The Sunderban cases have stood in sharp contrast to these experiences, with a comparatively high rate of payment collection in comparison to the rest of India (Ulsrud et al. in progress). In one village the reported collection was as high as 100% (Shrank 2008:7).

6.2 Rising non-compliance

The supply system worked well for about a decade (Winther 2012:116), then it was apparent that something had changed. People had gradually stopped complying: they were not paying their electricity bills, they were stretching illegal connections to

neighbors and bypassing electricity connections, and they were using more electricity than allowed (Ulsrud et al. 2011:7).

How did this happen? It is the voices of customers, BC-members and operators that will shed light on the situation for us, supplemented by the accounts of the two WBREDA officials and the contractor. On Sagar, two Beneficiary Committee members and one member of the Electrication Committee were interviewed – Bhavik, Bimal and Brinjesh – and on Moushuni, the committee members Bhumit and Basant participated. All operators of the power plants were interviewed: Ovijan and Oorjit at Moushuni, and Osman, Omesh and Ojayit at Sagar, in addition to Ojas, the Sagar lineman. On Sagar, the customers Chittesh, Charu, Chandrik, Chakor and Chandraban were interviewed, and Chandesh, Chirayu, Chetan, Chatena, and Chahel on Moushuni. It is these twenty-one voices, speaking about the lack of control or awareness, and the shortcomings of the technology, the state agency, and other customers, that will aid us in the analysis of the situation.

Chakor, Brinjesh and the others live in five different villages in Sagar and Moushuni (see Appendix 3 for details). Their situations differed slightly, yet had similar components. In *Kamalpur* on Sagar, the power plant had been out-of-operation since 2009. The customers had not paid since the beginning of 2008, when capacity first started declining. In 2009, the cyclone Aila had totally destroyed some of the solar panels of the mini-grid and stopped operation of the plant. WBREDA had recently brought in new batteries, but they had now been moved elsewhere.

In the Sagar village, *Khasmahal*, the power plant operated on seven-year- old batteries, supplying two hours of electricity every day as of February 2010 (Ulsrud et al. in progress). It received new batteries in February or March 2011**,** but as of August 2011 only 36 customers had an electrical connection, because there were problems with the distribution lines as well as the strain of the monsoon time.

In the last village on Sagar, *Natendrapur*, the power plant supplied two to three hours every day by February 2010, with 40 out of 200 customers disconnected due to reduced capacity. The power plant was out of operation from January to July 2011, because of problems with the battery, controller and inverter. When the batteries and inverter was replaced, operation started again. However, the problem with the controller remained and during the monsoon time the plant was only supplying power for two and a half hour every day.

In Moushuni, the two power plants in *Baliara* and *Bagdanga* differed greatly in terms of capacity. In Bagdanga, the batteries had been in operation for seven years as of 2010, and only supplied power for two hours every day. The batteries had been replaced and the power plant restarted operation in August 2011, after an interruption in service for about a year. Baliara on the other hand, faced a different situation in 2010, as the mini-grid was also operating on seven- year old batteries, yet with five hours capacity (Ulsrud et al. in progress). Battery banks were replaced in May 2011, and by August 2011 the estimates on daily hours of supply spanned from two to five hours the previous two months, and likely reflected variances in daily supply during monsoon time.

As per August 2011, none of the customers, neither on Sagar nor Moushuni, were paying their bills (WBREDA2), and overuse was widespread. However, it appears that the extent of overuse differed between the two islands. While Ojas on Sagar estimated that 15 per cent of customers used more than allowed in his village, estimates on Moushuni were generally higher. Oorjit gave the most modest estimate on Moushuni. He guessed overconsumption to be around 50 per cent, while the Moushuni villagers Chahel and Chirayu, estimated respectively between 50-80 per cent and 90 per cent of customers to overuse electricity.

6.3 Explaining non-compliance

6.3.1 The villagers' explanation

Among the consumers, the poor state of the technical parts of the mini-grids was frequently cited as the main problem, and the reason for why non-compliance had become widespread. A composite version of the story customers would tell sounded like this: "There was a technical problem and people were not getting the service they were paying for. Then the BC stopped working, because they could not monitor customers when they were not getting any service. The customers did not want to pay when they were not getting their entitled services. They were paying the same amount as previously, but now were receiving poorer service – which made them compensate by overusing. They continued the overuse as there were no punishments."

The story sounds convincing, but lack certain elements. Can we simply explain the declining capacity situation the customers found themselves in as "a technical problem?" If we did, the customers would be thrown directly into the "tragedy." Garrett Hardin, the "father" of the tragedy, would say so, as he believed there could be no technical solution to the problem of the commons (Hardin 1968:1243). When neither the technology in its present state is working, nor is better technology available, an explanation of the "technology problem" as the actuating cause involves predicting that customers will continue to overuse electricity until the power plants stop working.

The excuse of technology being the cause of overuse and non-payment can also be questioned by asking why the capacity of the power plants declined. Two aspects should be accounted for here. First, capacity had also previously gradually declined over time, but without non-compliance rising. Second, it appears that the decline of capacity had accelerated faster than the anticipated natural decline over time. The current decline could not account for why the customers reacted to the decline with non-compliance in the late phase, and not the early phase. Also, we should acknowledge that humans have agency, but not technology. This might imply that non-compliance was not only caused by the failure of technology faults, but that non-compliance was implicated in the technological decline.

Similar to the frustrations of scholars in the field, customers are not satisfied with mere explanations. They also want solutions. Their solution to the problem of non-compliance is commonly seen as implementing more control. Omesh put it like this; "We cannot stop overconsumption, but we can control more." In many cases, several co-existing control mechanisms are called for, like when Chakor demands "better checking systems, permission to cut lines, higher fines and implementing a national law." However, we should be cautious about calling for more controls as the solution to the problem before we know whether lack of control can explain the variation.

Lack of control cannot account for the *change* in the situation. Customers complied for a decade, but the type of control mechanisms have remained the same. Technical devices to control consumption are lacking, but compliance had earlier been ensured by people employed or volunteering to ensure compliance – such as the BC-members, the line man and money collector, whose jobs had been to deal with matters of non-payment and non-consumption. These people's presence had ensured

compliance, and the control enforced by these "officials" is therefore essential to gain a useful understanding of the situation.

For instance, customers are now frequently blaming non-compliance on either the money collector or the BC-members for not doing their jobs properly. At Moushuni, Oorjit blames the absence of the money collector for non-payment to be the prevailing problem: "The previous collector did not do his job properly. There were no punishments, so people continued not to pay." Many customers also point to the low penalty fee, calling for at least doubling of the fee. Apparently, the enforcement of compliance was sufficiently ensured by the Beneficiary Committee, linemen, money collectors and the sanctioning of penalty fees in the early phase, but this was not sufficient to ensure compliance in the present situation. To understand the variations in compliance, we must understand why the presence of the BC-members, linemen and money collectors were no longer sufficient, and also why they stopped doing their jobs.

6.3.2 An explanation of trust

Such processes of change are not as easy to identify for the customers, as they are situated within the situation. However, by comparing their accounts, patterns can emerge and lead the way to factors that can explain our phenomenon. For instance, the explanation for a high degree of compliance to rules in previous studies has been regarded as a direct result of strong local norms for compliance (Winther 2012:118). Garrett Hardin has also suggested that such a change can be explained by growing self-interest. However, from chapter three and four, we know that other factors also can effect the situation; such as expectations, knowledge, cognitive limitations, past experiences, provision of arenas for conflict resolution, methods to monitor non-compliance and possibility to affect internal policy-making over time, which all potentially can explain the situation. As we want to account also for these, we will attempt to trace them by employing the notion of trust.

To trust or not to trust other customers is seen as a *choice* every customer makes. They might reflect upon it, or they might not, and the volunteer nature of it can vary with their access to other options. Situations involving cooperation, like here in the Sunderbans, are the most complex trust systems. In such situations, trust appears as a set of bets directed at *each of* the partners, judging everyone in terms of whether they

will fulfill their parts of the agreement (Sztompka 1999:62-63). To provide a full explanation of why every single customer took a bet on trusting every other customer would be hard, maybe even impossible. It would require access to the motivations, dreams and reasons for actions from all the individuals partaking in the supply chain, – which only to differing degrees can be seen as conscious choices.

In a supply system with, for instance, 100 customers, it would imply that we would need to analyze the bet each individual makes on the other 99 customers. The approach here will therefore not be to analyze all separate trust relationships, but let various dimensions of trust shed light on the customers' accounts to further understand why they act as they do. Through the concept of trust, we can see the choices the customers make in the early phase and the late phase as varying with degrees of knowledge, risk-interpretation, voluntary commitment, interest, past experiences and expectations.

For instance, we can analyze the high degree of customer compliance in the first decade through the lens of regarding trust relationships as based on stable expectations of how others' will act in the future. Customers trusted the supply system because they expected that other customers would comply with the rules. They knew that there were rules that everyone agreed to follow and that BC-members, linemen and money collectors would enforce if someone tried to cheat the system. Even though customers would not trust all their fellow villagers on all matters in life, they trusted them to comply with the electricity rules, because they knew they would be punished with a penalty fee if they resorted to non-compliance.

6.4 Tracing socio-technical processes

The most important question to pose here is, how did the situation change? Trust relationships are vulnerable to change. By identifying how various configurations of the elements of the trust relationship have changed, we can provide a better explanation for why the situation was pulled out of its stable equilibria. The following discussion will outline why the situation went from compliance and non-compliance, and why it is so challenging to return to compliance. Processes that have affected peoples' choices will be grouped into three main categories: *technological change, changing needs* and *political change.*

6.4.1 Technological change

One of the reasons for why the situation is so complex is that the customers do not only need to trust the other customers' actions, but also the technological system to which they have a relationship. However, the trust ascribed to the supply systems is also related to people, as we can only rely on technology because we rely on those who design the systems, operate them and supervise their operations (Sztompka 1999:46).

It is therefore not only the expectations the customers hold to the other customers' actions that can explain compliance or non-compliance, but the way customers are situated within the larger supply chain. If customers are to trust the supply chain to work, they need to trust all those holding responsibility within the chain to do their jobs. Customers need to trust the operator to clean solar panels, refill batteries with distilled water and to limit the supply during cloudy days. Contractors and suppliers must be trusted on being able to supply the distilled water and spare parts when needed, and WBREDA needs to be trusted to follow up on its responsibilities, such as replacing batteries.

However, in the present situation, suspicion exists towards all these people. Chakor, for instance, says that "the previous experience with WBREDA is not so good," and shows no faith in WBREDA to do a better job in the future. Chandraban believes the problem is that Ojayit, the operator of his village's power plant, is not doing his job properly. Ojayit, on the other hand, is angry at the contractors for not supplying him with sufficient distilled water for the batteries. But why does Chandraban believe that Ojayit is not maintaining the power plant properly, and why is Chakor's experience with WBREDA so bad?

Let us start in Chandraban's lacking trust to Ojayit. Ojayit is part of – and a representative for – the institutional set-up of the supply system to which Chandraban is connected, as he is employed to operate the solar mini-grid. Trust in institutions is dependent on the competence and perceived will of its representatives to do their jobs, and all the operators, Osman, Omesh, Ojayit, Ovijan and Oorjit, can be seen as competent to do the jobs they are employed to do. They know perfectly well how to operate the power plants on a day-to-day basis. However, they have not been given any training on how to repair its mechanical parts, as this is the job of the contractors. As the operators' employers, contractors are to support operators by answering phone calls and sending

competent people when repairs are needed. Their ability to follow-up during the first phase is uncertain, but the problems currently faced suggest that something has changed from the early phase to the present.

The contractor is supposed to visit every month, yet instead he is now managing everything from Kolkata (Osman), and is not answering the phone (Ojayit, Osman). The absence of contractors causes problems, because when mechanical failures in the inverter or the controller, for instance, are not repaired quickly enough, it can negatively impact the plant's overall performance. A similar situation exists with the supply of spare parts and distilled water – when they are not supplied promptly, it is challenging for operators to do their job properly.

In addition, Ojayit says that he is paid irregularly, with a four to five month interval, making it very difficult for him to manage his daily life. This only adds to the general challenges of the job as an operator. Ojayit has to stay at the power plant around the clock, missing out on social life at night, when other men are at the market drinking tea and playing cards. In addition, pressure from customers to supply more electricity than capacity allows can add to the stress (Ulsrud et al. in progress), and all these issues might influence his motivation to do his job. There are therefore three things that might explain why Chandraban does not trust Ojayit to do his job properly: the lack of technical competence to do minor repairs in the absence of competent personal from the outside, the challenges that a lack of maintenance equipment poses for the sustainable operation of the plant, as well as the suspicion of declining motivation, as Chandraban knows Ojayit is not paid regularly.

But why are the contractors not following up with Ojayit and the other operators as they are supposed to? This remains unclear, as the contractors claim that operators are paid on time, and that they have people on the local level who regularly follow up with operators. Bimal, however, say that the contractors are not so interested in coming to the Sunderbans, as they are a long way from Kolkata and transport costs are high.

If it is hard for contractors to follow up from Kolkata, one might suggest the operators should receive training on how to do basic repairs. All operators expressed that they would like to have such skills, while WBREDA and the contractor agree that it would be advantageous. However, it is difficult to implement, because trained personal are eligible for better salaries, which they cannot afford within their budget (Waahid, contractor). They are also afraid that the operators will leave for better jobs if given

more technical education, probably with good reason. Oorjit says, for instance, that he is ready to leave his job if any better opportunity arises. Currently earning only 2000-3000 rupees a month as operators, the operators' expectations for monthly salaries range from 5000-7000 rupees, as 5000 rupees (around 90 USD) is said to be the current average salary on the islands.

In the absence of contractors, operators have grown accustomed to relying on WBREDA. Ojayit says that he calls WBREDA first because things go faster and because "WBREDA has power." However, even though a large amount of resources, in terms of both follow-up and financial resources, was invested in the early phase, WBREDAs ability to keep up with demand using the same amount of resources has not been sufficient. These are, in Shrank's (2008:11) words, WBREDAs "showcases," which have been important for the state agency to succeed. They have, therefore, shown great willingness to help the villagers, but with their office five hours away and other projects to attend to, WBREDA has found it increasingly difficult to live up to the customers' expectations. In addition, WBREDAs former director, and the main driving force behind the power plants (Ulsrud et al. in progress), has left for a private company. His absence is also seen as contributing to the problems because, without him, WBREDA lost several important contacts in the government (Bimal).

With the responsibilities in the supply system unclear, and with a lack of options for customers to sanction others who do not fulfill their duties, such as the contractor not following up on projects, the reasons for customers to mistrust the general performance of the supply system has increased. As with trust relationships in general, this starts to influence changing expectations in the relationship. When Chakor says that, "the previous experiences with WBREDA are not so good, so I have no expectations," it reflects how people had grown accustomed to relying on WBREDA in the early phase, with WBREDA eventually being unable to live up to the same expectations. On the other hand, this change highlights the dimension of risk within trust relationships. It has become more risky for customers to trust that others in the supply system – not only other customers, but also operators, contractors and the state agency – will live up to their expectations.

6.4.2 Changing needs

At the same time as it is harder to trust other agents in the supply system, the "betting risk" of customers in the trust relationship has grown higher – more is now at stake. The lifestyle on the islands has changed from the early phase of electrical power supply to the current situation. In the start-up phase of the mini-grids, WBREDA struggled to convince villagers about the advantages of electric power and few were ready to sign up as customers (Ulsrud et al. in progress). Now, however, capacity was reached many years ago and customers are reported to be on waiting lists (Omesh, Bhavik, Ulsrud et al. 2011:7). Over the years, not only have more customers decided that they want to connect to the mini-grids, the desire to consume more electrical power per customer has increased. How did this happen?

The solar mini-grids were not only intended to bring light, but also to aid villagers to improve their own financial situations. Whether it was access to electricity or other factors, the financial situation of the islanders has improved significantly throughout the last decade, especially on Sagar Island (Chakrabarti and Chakrabarti 2002:38). Customers report that electrical power supply has opened up new sources of income and facilitated "lifestyle changes." In addition, work migration, for instance to Arab countries, has become more common. Chetan, for instance, has a son working as a driver in Dubai, and it has become more common for young people to leave for one or two years. This increased ability to pay for electrical power seems to have lead to a desire for more electricity. Like Ovijan says, "It is good economic conditions – some people have even started using freezers. People are ready to pay."

And it is obvious that customers want to use more than they currently can access. Most customers would describe electrical power as the most important requirement for a good life, closely followed by income generation and the capacity to earn enough money to support a family. They also emphasize that clean drinking water, connecting roads, protection (from example, the collapse of sea embankments), sewage facilities, pumping water systems, fresh air, general health and education are important to them – and many of these services are hard to facilitate without access to electrical power.

Electrical power supply was also seen as a key to "lifestyle changes." Electrical use is a means for children to pursue further education, with the purpose of getting good jobs like government service jobs, doctors or engineers, or to run a business. Customers

are also increasingly discovering the enormous possibilities associated with electrical access. Small electronic businesses have been established around the islands, with people buying all sorts of new appliances. In Baliara, a few people had even started using refrigerators, computers, copier machines, battery chargers and color TVs (Ulsrud et al. in progress). This is not yet common, but it is increasingly popular for wealthier villagers to install solar home systems. Chetan at Moushuni, for instance, have a TV, CD-player and a computer. Chetan is still dreaming of 24-hour connections, because then he could use a fan, a heater and a freezer.

Increased access to electrical power is not only seen as desired, it is also increasingly felt as needed. Two global developments have increased the perceived need for electricity. Before the year 2000, the only way to communicate with the world outside of Sunderban was to physically travel there. In 2004, the Sunderban Islands were connected to the telephone network (Danda 2007:72-73), and after some years, mobile technology became cheap and accessible. Most households now have access to mobile phones, increasing the need for electricity to charge them. In addition, the emergence and importance of the Internet has also exploded globally during these years, and knowing how to use computers, has rapidly increased in importance.

The villagers are increasingly aware of the role information technology has in getting good jobs and securing decent futures for their children. Access to TVs and radios has probably also increased their awareness of the world outside of the Sunderbans. As Chetana, one of two informants with a computer, says: “With a computer in the house, we can do net searching, get knowledge, fill out online forms, take online exams and do ticket reservations. This opens up new possibilities and increases our general life chances.”

For all these reasons – improved capabilities to pay, understandings what electrical power can do, and an increased need for electricity to keep up with the rest of society – the desire to use more of it has increased. In other words, the interest the individuals have in their trust relationship to the supply system has increased. Many regard the inconsistency between supply and demand as the reason for overuse. Like Chahel said: “Many people think that four to five hours a day is not enough – that’s why they over use.”

In addition, customers have now grown accustomed to having access to electrical power, making it harder to return to a life without it – or with less of it. Electricity has

changed their lifestyles by, for instance, making it easier for them to go to the market at nighttime. As many are using the extra hours of the day for productive purposes, the lack of access to electricity may imply decreased income. It would also suggest that children would not be able to study long hours as they have become used to, and perhaps lag behind those children whose parents can afford solar home systems. They will no longer be able to watch TV, it will be much harder for them to charge mobile phones, and those now accustomed to relying on table fans to escape the heat must acclimatize to the heat again.

After more than a decade of supply, electrical use has become "embodied" in their lifestyles, and embedded in their routines, ways of communication and time schedules. Their practices and expectations have changed, and they have allowed themselves to dream of a better life. All these things – changing expectations, an increased interest in using electrical power with an increased capacity to pay for it, as well as new use patterns and new demands from the world outside of the Sunderbans – make it harder and harder to comply with the rules. More is at stake. Simply put, the interest they hold in the trust relationship to the supply system has greatly increased from the early phase until now.

In addition, those who monitor compliance, like the BC-members, linemen and money collectors, feel the same needs. Ojas, the lineman in one of the Sagar villages, expressed that even though he was the one who sanctioned overuse, he also felt a need to use more than the system allowed. Ojas especially highlighted the need for using electrical power for productive purposes. He admitted that he had overused at one point, as he needed it to pack betel leaves. In the season when farmers are packing betel leaves, Ojas said that they needed either two liters of kerosene for the packing, which is very expensive, or five hours of electricity. As he put it; "Because we also needed to use other lights that day, we overused."

The fact that these monitors are part of the local society has probably been advantageous in some ways, but also posed challenges. The legitimacy they and others attach to their roles also appears to have changed from the early phase to the current situation. The confusion and suspicion that the mix of politics and administration can lead to may have contributed to two things here: committee members becoming uncertain on how to do their jobs, and customers doubting whether they can rely on committee members.

6.4.3 Political dynamics

We have institutions that *represent* us, such as our state governments or various interest organizations that we hold memberships in. Within those institutions are people to whom we delegate authority and who make decisions and carry out actions on our behalf. Our trust is dependent on whether these representatives carry out their tasks as we expect them. For this we rely on *procedural trust* (Sztompka 1999:44)**.** In democracies, such procedures can be elections, representation and majority vote, and we have seen that both Elinor Ostrom and Bo Rothstein's have emphasized the importance of impartiality with such institutions and procedures (Rothstein 2005:50, Ostrom et al. 1999:279-282).

It is difficult to say for certain whether the customers trusted relevant institutions like WBREDA or the Beneficiary Committees in the early phase. However, the experience of the current situation may suggest that something has changed, especially when comparing the situations on the two islands. The supply system has been organized differently on Sagar and Moushuni, both because of the differing sizes of the islands, and their political and administrative units.

On Sagar, a Cooperative (Sagardweep Rural Energy Development Cooperative Society or SREDC) has been formed, with the main responsibilities of the collection of tariffs, accounting work, and sending revenue to WBREDA. In Moushuni, no such Cooperative has been formed and, instead, the Gram Panchayat has played a similar role (Ulsrud et al. in progress). WBREDA originally intended the Sagar Cooperative and the panchayat on Moushuni to own the power plants and be primarily responsible for its operation, but the Cooperative's role has turned out to be less significant than intended.

Procedural trust relies on rules for election, representations and majority vote to be followed. For elections of members of the Beneficiary Committees, no formal guidelines exist. The head of the Gram Panchayat and an additional panchayat member usually form part of the committees, and the rest of the members are other customers who have been appointed by one of the political units, either Block level or panchayats (Wasan).

Sagar and Moushuni differ in both their political administrations and the election of members to the Beneficiary Committees. While Sagar is divided into seven mouzas and governed by seven Gram Panchayats, Moushuni has four mouzas and is run by only

one Gram Panchayat. Omesh and Bhavik mentioned that three out of eleven members of their village's committee on Sagar were politicians, and these had been appointed by the Block level in an early phase (Ulsrud et al. in progress). On Moushuni, on the other hand, there was only one committee, and all the seven members were politicians, and elected by panchayats (Bhumit). Moushuni does not only have one Gram Panchayat, they only have one Beneficiary Committee for both power plants – and the leader for both the panchayat and the BC is the same person (Ulsrud et al. in progress).

If people are to have trust in procedures, they must depend on the procedures to be carried out in a uniform way. The customers' accounts suggest that this is not the case in Sagar and Moushuni. Chandraban explained it like this: "Officially, there are punishments if you use too much, but unofficially, these are affected by the personal relationships between operator and customer." He describes this as a sort of ground-level corruption, in the form of "go to their house, give them some rice type of corruption". He regards politicians as the main culprits for their problems, stating that "they should fix corruption first, then they can change the batteries." Other customers' accounts support Chandrabans story. Chirayu says that if a customer is disconnected due to overuse, the fine he has to pay to re-connect varies. The fine is supposed to be 100 rupees, but Chirayu says that is sometimes can be 40-50 rupees, sometimes more.

The truth of such accounts is hard to judge. We do not know whether this is a big problem, or whether these customers' views on politics are influenced by personal sympathies or prejudices. Still, they are important to acknowledge, as they form part of these players' reasons for behaving as they do. If rules are perceived as not being followed in a uniform way, people will raise their guard, and become more suspicious of people in positions to abuse power.

Abusing these positions in such ways can affect the general perception of customers in the capabilities of those controlling and representing them to do a good job. In small communities such as these, word of the mouth travels quickly. In addition, when committee members are appointed politically, suspicion can be further complicated by differing political sympathies. Political polarization – or groupism (the existence of in- and out-groups) – is seen as a common hindrance to the implementation of community projects in heterogenous communities (Malhotra 2006:41). On the Sunderbans it is also believed that political affiliations can make it relatively harder or easier to access general services, such as tube wells for potable water (Danda 2007:39).

Difficulties can arise because it can be difficult to separate between the personal sphere among neighbors and the professional sphere of the customer relationships.

An incident that took place during my fieldwork at Moushuni illustrates this. The interview with Basant was delayed because he had to settle business between the lineman and another customer. The lineman of the village had cut the customer's distribution line during the night, because he had some personal agenda against this customer. Hence, the lineman took advantage of his professional role to take revenge related to a private matter.

Potential problems with mixing politics and the administration of electricity supply also might have been aggravated after political power changes following major elections. Political tension is said to be intense in West Bengal (Danda 2007:39), and for Moushuni, with only political members in the customer committee, this might have impacted the situation. Inhabitants may have started to feel increasing political distance with committee members following elections at Moushuni in 2003, when the Trinamool Party took over for the communist coalition previously governing the island (Winther forthcoming). Political issues were frequently mentioned at Moushuni, and during fieldwork, a WBREDA representative gave me last minute instructions to not sleep in the spare room previously offered at one of the power plants at the island, because the WBREDA representative feared the political instability.

At Moushuni, the Gram Panchayat is responsible for collecting fees (Ulsrud et al. in progress). However, the panchayats are said to support the customers' refusal to pay, as they believe the customers are entitled to withhold pay when they are not getting the services they are promised. With local politicians and ordinary customers living side-by-side in the villages, the probability for panchayat members to both understand – and give in to – their fellow inhabitants' demands are high.

The pressure the BC-members face from customers can lead them to make various unsound decisions. The panchayat on Moushuni, for instance, had allowed people to make bypass connections, implying that they could use more light points than initially agreed as long as they used energy efficient lightbulbs like compact fluorescent light (Chirayu). Bhumit, a committee member and politician, states that "electricity is the most important thing in the people's lives." By extension, we can assume that issues that are important to the people are important also to the panchayat members. Therefore, the panchayats might be susceptible to giving in to the customers' demands to secure

votes, especially as it is WBREDA, and not them, who are accountable for repairing the damage caused by the customers' actions. In addition, WBREDA might be used as a welcome scapegoat, since people commonly associate widespread graft and corruption with the state. In the people's mind, state owned utilities are identified with the state and electricity is perceived as state property (Gulati and Rao 2007:129). So, as a state agency, WBREDA is seen as a representative of the state.

Certain narratives also circle the islands, which might be intended to put politicians in a more favorable light**.** The way politicians frame the situation can shape the customers' perception of how things are working. Ovijan, for instance, believed politicians were misguiding the people, by telling them that they do not have to be concerned with how much electricity they used, because the plant would not last long anyway. Politicians based this argument on the claim that the main grid would be coming to Moushuni soon, making the power plants superfluous.

However, this assumption was not correct, as grid connection to Moushuni is not expected to happen for at least 15-20 years (Wasan, WWF). Such "misguidance," as Ovijan calls it, can also happen by providing wrong information, for instance by allowing customers to make bypass connections provided they use only CFL bulbs. Chirayu, for instance, believed the problems of the mini-grids decreased after they stopped using the regular light bulbs, believing that the major problem was the bulbs, because they drew so much electricity. He said that "for running the TV and tape recorder, they do not need so much electricity, so they can manage everything now."

Chirayu's perception of the situation illustrates how political framing of the situation can obscure causes and effects. For instance, if the use of bypass connections makes people increase electricity consumption by starting to use more electricity intensive devices, problems will only be aggravated. The use of such political story lines destroys the trust in the system in two ways. First, for the informed customers, like Ovjian, it decreases trust to those monitoring and making decisions about the system. Second, in the long run, all customers will be less ready to trust the system in general, as problems will steadily increase and it will be harder and harder to place blame.

6.5 Looking for solutions

While the trust in the supply systems was initially facilitated by a belief in rules, monitors and other customers to act according to the agreement, the factors discussed above have gradually changed the system through the years. The need and desire to use electricity has increased over time and – as predicted by Garrett Hardin – the aggregate of these individuals' self-interest has put strain on the system.

However, rising self-interest does not offer a full explanation of the change from compliance to non-compliance, as the customers' accounts point to other factors. Scholars like Ostrom and Rothstein have predicted that whether people agree on cooperating or not will depend on whether they believe that others can be expected to following the rules of the agreement. The growing lack of faith in other people to either follow up on their responsibilities or comply with the rules is likely to have influenced peoples' choice of compliance or non-compliance, as no one wants to "be a sucker", like Poteete, Jansson and Ostrom (2010:150) put it.

For the monitors at the local level, they may have felt increasingly unsure about the legitimacy of their own monitoring role in the face of declining electricity supply. In addition, they also had a need to use more electricity. With the monitors starting to doubt the legitimacy of the system, the possibility of maintaining trust towards the whole system had become increasingly vulnerable to falling apart. All these factors together – increased interest in using more electricity, suspicion of the impartiality of institutions, lack of resources to sustain the system, and a growing wariness about whether others could be trusted – have driven the situation on the Western side from one of compliance to non-compliance.

This is not an ideal situation, and WBREDA has started taking steps to solve it. Contrasting the solutions with more formal control that several customers called for, WBREDA has taken another approach, now deciding to transfer the ownership of the power plants to the panchayats (Waahid, Wasan, Bimal). The mini-grids will be transferred to the panchayats following renovation of the plants (Wasan).

The transfer is rationalized by the need for so-called *social engineering*, in the sense that WBREDA wanted to consider social factors to a larger extent (Ulsrud et al in progress, Waahid). The customers' diminishing sense of ownership is problematic, because it makes them less motivated to take proper care of the plant (Ulsrud et al. in

progress). WBREDA sees the panchayats as more capable of taking care of the power plants, because the panchayats hold more influence over the local inhabitants (Wasan).

This solution to the situation is interesting, especially since, as a state agency, WBREDA has decided on a path that specifically contrasts the centralization solution that Hardin put forth. Will it work? The answer to that still remains in the future. However, the situation we will find on the Eastern side of the Sunderbans might offer some suggestions and predictions as to where the development on Sagar and Moushuni might be heading.

7 The case of Satjelia

> We're living in a new Kolkata. It's not Kolkata, but part of Kolkata.
>
> Bhavika

Happiness and gratitude were the dominant feelings of the inhabitants in the villages of Rajat and Jubilee on Satjelia Island, half a year after the installation of a solar mini-grid. Villagers had never thought the arrival of electricity was possible on this remote island (Bhavika), and suddenly, they felt "developed." Waahid visited the island shortly after the inauguration, and he is already praising the project, believing others should learn from it. Even though the project has just been recently installed, Waahid should know what he is talking about, after extensive experience with the cases on the Western side. Why is this project so promising?

7.1 An Indian 'Bushlight' project

7.1.1 Organizational design

The supply system is based on a different organizational model than the cases on the Western side, both with respect to funding, sharing of responsibilities and enforcement mechanisms.

The solar mini-grid on Satjelia is initiated and financed by the Asian Pacific Partnership and the Australian government (WWF). The project is built on an approach called the *Bushlight India* model, based on experiences with other projects in Australia. In Australia, similar projects have since 2002 been successful in providing indigenous communities access to reliable renewable energy services (WWF India 2011). The model includes comprehensive planning, following some main steps: the village is selected, and a village committee is mobilized, which aids the implementing agencies in identifying a plot of land for the mini-grid, and ensures the donation of the land. The villagers are then given an education on energy services and solar PV-systems, a

required level of community contribution is identified, and then the villagers receive training on household energy planning and budgeting (WWF, CATprojects 2011).

While WBREDA originally was highly innovative in their approach, the Bushlight project has gone even further in involving the users. One of the most important parts of the organizational model is that it is owned by a cooperative society. The cooperative was registered as part of the implementing process, and all customers are shareholders in this cooperative (WWF India 2011). Those who chose to be customers received household distribution lines free of charge, as it was included in the projected cost of the Bushlight project. These customers pay electricity fees which – similar to those on Sagar and Moushuni – are based on flat tariffs. The minimum supply of electricity that is required to be a customer is 200W per day per customer, costing 150 INR a month, with 75 INR added for every 100W they choose (WWF, Omja).

7.1.2 Local management

The mini-grid supplies electricity for four different *sectors*: households, streetlights, the village's school, as well as the power plant building, and the daily management is handled by an operator and a customer committee. The operator, Omja, is mainly responsible for the operation. Unlike his operator colleagues on Sagar and Moushuni, Omja is not required to live at the power plant. Instead, he lives with his family, does farming in the daytime and comes to the plant in the evening to manage a log book, logging the daily consumption from each of the four sectors. Weekly and monthly he writes and files his reports.

These logs and reports provide information on how the operation of the plant is doing over time. He notes whether some sectors have been turned off, or if there have been any problems with the distribution lines. In the case of any personal problems that Omja needs to deal with, he can always ask his backup for help, as another man in the village also has been trained to do the operating job. One of Omja's monthly tasks is to handle the collection of electricity fees, which customers pay by coming to the power plant. If someone is unable to pay, Omja will turn it over to the customer committee to take care of it.

The members of the customer committee, called *The Board of Directors,* were elected at a general meeting. The Board has twelve members, where three are

representatives from WWF, WBREDA and the Gram Panchayat, and nine are customers (Bhavesh). Bhavesh and Bhavika are two of these nine customer members. As Bhavika explains, they are meant to be "the path finders,"' or the leaders, of their fellow villagers. The main reason for choosing them, according to Bhavika, is because "they are able to control the people."

The Board's responsibility is to look after the general management of the mini-grid and take care of problems, like arranging customer meetings if they are needed. Most of all, they are customer *representatives*, and major decisions cannot be taken without consent from the customers. As all customers are shareholders, all have equal rights to attend meetings, contribute to decisions, and request the Board to call meetings if it is required. Together, the shareholders have decided on the size of monthly electricity fees, the minimum monthly amount that is required to obtain connection, and planned the general budget, which was based on calculations of predicted future costs provided by WWF (WWF).

The Bushlight project has managed to implement one of the things highly desired by the customers on the Western side of the Sunderbans; *Urja Bandhus,* which resemble electricity meters and are installed by all customers in their homes. They are programmable energy managers, differing from normal current meters in that instead of measuring consumption, they are programmed to supply a pre-determined amount of electricity. The device limits customers' consumption and, at the same time, provides them with an overview of how much electricity they have left to use. The Urja Bandhu displays the remaining amount of electricity with five lights shining in yellow or green on the boxes.

The Urja Bandhus make it possible to supply electricity from the plant around the clock, and are programmed to be refilled with electricity every day at 4 PM. Customers can control when they want to use the electricity during the next twenty-four hours, before the next re-fill (WWF). The Bushlight project has also installed extra safety guards to ensure stability in electricity supply. In addition to the energy manager, each household is connected to a *junction box*, covering three to four households. In both Urja Bandhus and the junction boxes, there is an electric switch that makes the power go off every time a customer tries to use more than 200 W (Omja). An extra safety measure is also that the distribution lines are armed, differing from other off-grid installation sites where the wire is often naked (WWF).

7.2 “It’s the best. It’s our own.”

The Bushlight project has incorporated both the technical control devices and the local ownership that the cases on the Western side aimed to implement. Is it working? Judging from the accounts of Bhavika, Omja, Chinmay and others, it appears so. The lifestyle has already started to change, students have more time to study, commerce is steadily growing, with an increasing number of shops, and the market opens every day (Bhumik). Such positive effects were also present at Sagar and Moushuni. However, if comparing the present state at Sagar and Moushuni with Satjelia, it is the satisfaction at Satjelia that is most striking.

7.2.1 A feeling of responsibility

For these customers, the satisfaction appears to be strongly tied to their ownership model. The *feeling* of ownership is frequently highlighted by the customers. They all know they have the right to ask questions and they know that all the money they collect from the fees is for themselves – as a collective. Bhavik describes his satisfaction by saying, “WBREDA and WWF can only advise us, but we can decide everything for ourselves.” When asked whether the cooperative is a good way to manage the supply from the mini-grid, the customers all answered affirmatively, with descriptions such as:

> It’s the best. It’s our own, so we have an ownership mentality – all the customers feel that they have responsibility, so they take care, which they wouldn’t do with another system. All the people are from the local area, which makes them take care.
>
> Cavin

However, it is not only the ownership model that is seen as important in the success of the system. WWF also wishes to emphasize the importance of good technical performance. According to WWF representatives, the vicious cycle of non-compliance that arose at Sagar and Moushuni was mainly due to the low quality of service from the mini-grid. They believe that when service and supply are of good quality, 80 to 90 percent of the people will pay (WWF).

The Urja Bandhus are also important. When asked whether it is possible to cheat the system, everyone replied negatively. There has been one incident of attempted cheating. An Urja Bandhu was disconnected from the distribution line in one of the

customer's homes. However, this attempted bypass was easily discovered, as it made the whole electricity supply break down for one day. The customers say that this customer was obviously embarrassed afterwards, and claimed that the tampering with the connection had happened without his consent. The Urja Bandhu was located outside of his house, but he was still viewed as being responsible for caring for his own system. Bhavesh said that the customer was punished by a two month suspension in connection and a fine of 500 rupees.

This incident has probably positively affirmed the customers' trust in their system. Other factors have contributed to this being a system of trust: the customers' knowledge of all the relevant parts of the system, the clear division of responsibility, the control they have over making decisions because they are shareholders, and the fact that they do not have to worry about other customers' compliance, because they have the Urja Bandhus.

But as we have seen on Sagar and Moushuni, other factors can also affect the capacity of the mini-grids and the customers' propensity to trust the supply system. A stable, viable supply is dependent on the operator's ability to do a good job and make quick decisions on when to halt the operation of the power plants. It also depends on people to following up at the plants for required repair jobs, and on the Board's capacity and will to commit to their job, by attending to issues of non-payments and unregulated behavior in an impartial and uniform way. However, in this case, the organizational model appears to be able to handle this by providing knowledge, enabling customers to make decisions on rules and regulations, ensuring a certain amount of flexibility and providing insurance for unexpected events.

The sharing of knowledge with the customers about both energy budgeting and financial budgeting is probably a good investment. With such knowledge, the customers' perception of what they can expect from the system is more realistic. Energy budgeting, for instance, played a central role in the planning phase, with WWF teaching customers about how much electricity different appliances, like lightbulbs or a black-and-white TV, consumed per hour (WWF). It has helped customers to tailor their daily needs to the supply, and plan their use of electricity.

WWF's training has also helped them in understanding decisions based on purely financial considerations. The customers have, for instance, learned that they should be careful about when to call the contractor. Frequent calls to summon contractors is

costly in the long run, so instead of calling every time something goes wrong, they wait until a sufficient number of small complaints accumulate before making the service call (WWF). If they feel that they do not have enough knowledge about a problem, they will just turn to the operator or the members of the customer committees.

The shareholder system makes it easy for customers to make their own decisions, and tailor the system to their own needs. WWF and CAT projects have given the customers only two rules: 1) do whatever you want, 2) just don't tamper with the systems (WWF). The customers can therefore establish their own rules and regulations, as long as the decision is taken in collaboration at customer meetings. This also enables customers to manage a number of problems on the local level. For instance, all complaints and problems are registered in a complaint book open to the public at the power plant. In case of an emergency, meetings can also be organized quickly. The operator can easily handle problems like an overload of the electricity system due to, for example, heavy load appliances like LCD-TVs or heaters, by setting the junction boxes off. In addition, there is always a representative from WWF present at the WWF office on the island, who can assist them with more complex technical matters (WWF).

7.2.2 A flexible system

On the climatically vulnerable Sunderban Islands, there is always a need to pay attention to climatic conditions. The monsoon can cause technical problems, because it challenges the regularity of the supply on a day-to-day basis. Thunderstorms can hamper the system, and there was one incident in the first season of operation where lightning struck the plant, closing it for five days (Bhavesh, Chinmay).

Such unforeseen events are accounted for through the provision of an insurance component. The Bushlight project differs from earlier projects by providing this insurance, because it had earlier only been a one or two years warranty (WWF). The insurance is calculated as part of the project cost, and includes insurance for cyclones, destruction of batteries and solar PV plants, etc. The Cooperative holds an annual maintenance contract with Tata BP, which makes approximately 10-12 visits per year. The cost of insurance is secured until the sixth year following installation, as part of the funding from the Asian-Pacific Partnership. After this, the customers will have to start paying for the Annual Maintenance Contract themselves, and the planned budget the

customers have made together with WWF has taken into account the need to save up for the future contract. If they have surplus money in year six after installation, they can use it for other production activities (WWF). Flooding during monsoon or natural disasters will always potentially happen, especially with the increasing threat of climate change. The insurance will probably be useful here.

The customers have different needs for how much electricity they want to use, which can pose challenges, as supply is based on a flat rate system with a minimum amount of electricity required. However, the possibility to "do whatever you want, just not tamper with the system" allows for flexibility in terms of adapting the system to different needs. One example is *internal energy trading* where, for instance, households that feel they need less than 200W daily can sell the remaining energy to shops. The village's doctor is an example of a customer who has used this option. He has an electricity connection in order to be able to offer his services to villagers at night. However, the doctor only needs three hours of electricity during the day, and therefore he sells the remaining electricity to others (WWF). While eight shops have gotten a separate electricity connection, there are also two to three shops which buy electricity from household supplies (Chudamani).

Many households and shops offer this kind of service to those who come to the Sunday markets to sell various goods; e.g. household selling of electricity to put up temporary tea stalls. In this way, some households can earn even more money than they pay for the electricity connection. People can also earn money on their electricity connection by selling electricity services to others, like charging mobile phones for others at the price of three rupees. Those who have access to electricity also have the advantage of selling the subsidized kerosene that all resident are eligible for, to others (WWF).

Despite the ability to trade energy, it is not always easy for customers to pay their electricity bills every month. Many are day laborers, with unpredictable income. This can make the collection of fees problematic from time to time. In cases where people do not want to pay because they say it is too much, the Board has to convince them that they have to hold to their side of the agreement. In other cases, customers want to pay, but are unable to afford it that month. The advantage of local money collection is that the Board of Directors can show sympathy to another villagers' strained financial situation, and show flexibility on payment, however, only to a certain extent. It is

possible to postpone payment for one month by paying for two months at a time, but if they are more than two months overdue, they are disconnected (Bhavesh).

Customers can even use the supply system to reap monetary benefits as a collective, by generating income by selling services connected to the plant. It is, for example, possible to sell distilled water for income generation for the plant. They can purchase distilled water in large bulk, and sell it from the plant to other people who need it for batteries for solar home systems around the island, and then put it in a collective fund where all income generation from the plant is invested (WWF).

All these factors make the Bushlight project seem promising for the future. The trust the customers have in the supply system is stable and secure. Customers know that if there are any problems, they can easily approach or sanction others on the matter, as they are all shareholders who have a say in the state of affairs. They can feel confident that the money they pay will remain safe in the bank, and that the supply system is guaranteed to work over time as they have insurance for it. They do not have to worry about other people cheating on the system, as they have the Urja Bandhus, and the training on energy budgeting help them to know how much electricity they have left, as long as they have kept track of how much electricity they have used. In general, they can simply be consumers who do not have to worry daily about customer relations. So, is this it? Is the Bushlight model the solution to the problems with the solar mini-grids?

7.3 Future challenges

Despite its advantages, the Bushlight project will likely face challenges in the future. One challenge is villagers' different needs for electricity. Customers have different abilities to pay, different needs, or both. Even though supply is more flexible at Satjelia compared to Sagar and Moushuni, they still have to pay for a minimum amount of 200W, which many customers think is too much. Opinions differ among customers as to whether they have too *much* or too *little* electricity. Some people say they only need 100 W daily, other feels that 200W is too little. The amount of minimum electricity required to obtain a connection was decided in a general meeting, but because of the relatively high cost compared to income, there have been questions raised about the minimum requirement of 200W daily. The minimum amount of 200W electricity is a large amount compared to the amount of 70 or 120W at Sagar and Moushuni, and the customers say they did not

realize how much 200W actually was when the decision was made. Omja says that they only need light in the evening, where they use around 80-100 W. The rest of it, he says, they try to use in different ways since they are paying for it, so they use it on fans or TV.

However, the need for electricity is predicted to grow, and the customers now complaining about having too much electricity will probably call for more electricity in the future. Rising needs from the customers will give rise to new challenges, as on Sagar and Moushuni. This has partly been accounted for in installation. When the power plant was installed, some unallocated capacity was included, implying that the mini-grid is able to supply an additional 5500 kWh per day without putting strain on the technology. This opens up several possibilities for use, and provides customers with additional scope in terms of making decisions on how the system should be designed and managed (WWF). This in turn suggests that those who currently are customers can choose whether they would like to allocate the extra capacity to increased capacity for themselves, or open it up for more customers to become connected. Other villagers have now seen the benefits of electricity, making the waiting list currently at around 30-40 households. The advantage of connecting more customers to the mini-grid means a decrease in the tariffs for all customers, which could benefit all.

It is only the shareholders of the power plant, not all inhabitants of the two villages, who will make the decision on the allocation of extra capacity. The shareholders will need to agree on two points of discussion here. The first is whether they should allocate more electricity to those who are already customers or allow the other villagers, who now have started to see the benefits of electricity, to connect. The second is a question of distributing the costs of connecting new customers. Installing distribution lines to the households of new customers is costly. While the current customers received the installation of distribution line to their homes for free, as it was included in the original project cost, the set up of new distribution lines to more customers would be covered by the customers themselves.

Those who are shareholders today, and those who would like to be customers in the future, disagree on whether new distribution lines should be paid by new customers or be covered by all the existing and new customers together. Those customers currently on the waiting list believe it would be unfair if they would have to pay for something others got for free. Bhavika says that any future agreement on how this should be handled would be based on a calculation by the committee at a general

meeting. However, there seems to be a “sharing mentality” in the village, with Bhavika describing the situation like this: “Only a few people are enjoying the electricity facilities, and other people have dreams to connect as well. We would rather use a small amount of electricity and have more customers.”

The organization model of the Bushlight project has incorporated a set of features, including both technical control devices and organizational factors, that make the villagers prone to trust each other, and apparently also more willing to share the benefits of electricity with each other. The project’s model also provides for long-term planning, increasing the supply chain’s resistance to pressures from the outside in the long run. This contrasts with the current situation at Sagar and Moushuni, where mistrust of other customers’ propensity to comply is widespread, and where it is unclear who has responsibility for the decline in supply over the long run. The problem as we now, in the following chapter, turn to comparing the experiences of Sagar, Moushuni and Satjelia, is that the cases on many matters are not comparable, such as, for instance, in terms of type of access and property rights. The comparison will therefore be, in continuation of the analysis in these chapters, be done on the basis of trust.

8 Trust and its limits

The way the Bushlight project is organized appears to be a promising solution for securing supply from the solar mini-grids in the long run. Yet, we cannot simply explain the compliance and customer satisfaction at Satjelia by looking at its organizational model. On Sagar and Moushuni, the supply systems were also well functioning in the early phase, but this did not prevent non-compliance from rising. The organization model on Satjelia is no guarantee that the electricity supply will function satisfactorily in the future, neither is it able to provide a full explanation of the variations.

The last chapters have shown that the Sunderban cases cannot be compared in terms of generally employed variables in the common resource literature, such as property type and access rights. First, the cases do not have the same kind of property type. While the customers on Satjelia own the solar mini-grid, the judicial responsibility for the mini-grids on Sagar and Moushuni rest with the state agency WBREDA. In the near future, with the transfer of ownership to the local panchayats, this will be changed, making the cases more comparable in terms of property type in the future. However, they will still not be fully comparable in relation to property type, because on Sagar and Moushuni, the mini-grids will be owned by a political unit, while the mini-grid is owned by a cooperative of customers on Satjelia.

Secondly, the appropriators of electricity supply do not have the same type of access. On Sagar and Moushuni access to electricity is communal (as opposed to open to all), with access to the resource being open among the customers, while on Satjelia, technical devices were installed to control individual consumption. These control devices make it difficult to define the access type. While some would describe it as a common resource, , it could also be defined as a private resource, as no one is able to extract electricity from other users. Both the description of the cases, and the discussion on common resource management, have made it evident that the boundaries between state, private, open and communal are complex and fluid, and therefore not desirable for using as main variables in analysis.

Because newer CPR analysts, such as Elinor Ostrom, have suggested that we account for both other institutional aspects and a more dimensional understanding of self-interest – *trust* has been used as an analytic concept to link individual behavior with

institutional design. The concept has facilitated an explorative approach to the subject, and has allowed us to trace a varied set of factors. In this chapter, the factors will be summarized and the cases compared.

8.1 Linking behavior and institutions

8.1.1 Individuals' reasons

Customers' reasons to comply or not comply with the agreement have been seen in the last chapters to be dependent on whether or not they can trust the supply system. Whether the customers have been willing to trust the overall socio-technical system of electricity supply has dependent on a number of interrelated factors.

First, different types of *knowledge*: about the complexity of causes that can lead to a decline in capacity; about the other agents' motivations and possibilities to choose to act in different ways; about the financial situation, long-term prospects and the way formal procedures are carried out; finally, the operators' and monitors' competence, time and willingness to do a good job.

Second, *experiences*: the experiences customers have with others – both other customers and institutions – form part of their knowledge, because encounters with others can shape their views on the situation. Experiences of rules being followed and non-compliers are sanctioned in a uniform way promotes trust, while experiences with customers bribing linemen or committee members reducing the fine for overuse for political sympathizers has a destructive effect.

Third, *expectations:* One of the factors found to decrease institutional trust in the literature is gaps between the expectations that citizens have towards government and the government's ability to satisfy these expectations (Gulbrandsen 2005:119). The expectations that customers have toward the implementing agencies, to the systems of the mini-grids, what they can do for them and what they will have to do to reap these benefits will shape their probability of acting in different ways, and can change over time.

These three – knowledge, experiences and expectations – have not influenced the systems in a uniform way, because the collaboration between customers is a result of "the bet" taken on each of their fellow partners (Sztompka 1999:62-63). It is the

aggregates of these bets, shaped by interests, dreams, norms, knowledge and expectations for life, which have caused the variations found in the Sunderban cases.

Knowledge is likely to be the most influential reason for individual motives, as both expectations and experiences depend on knowledge to some extent. Different degrees of knowledge can exist among the users of the electricity supply chain. For instance, the customers might be aware that overuse is a problem, yet still not understand the full meaning of it. Knowledge about how to use electricity is also fairly low compared to, for instance, those who have installed the mini-grids. This increases complexity, as the supply system in this context is also more dependent on users, operators and monitors to have an understanding of how these systems work. The interviews also indicate that information about the supply system is unevenly distributed within households, which can have affected the extent of compliance. If, for instance, women have less knowledge about the effect that non-compliance can have on the state of the solar mini-grids, it can affect the use of and state of resources in the long run.

8.1.2 The importance of institutions

The expectations of the "bets" we place on our fellow partners can be shaped by *the way* we are met by others. This is important to be aware of for all those who design projects, perhaps especially for development planners. Development projects are not intended to be charity, but can risk becoming so if nothing is demanded by the receiver. As Garrett Hardin saw it:

The demoralizing effect of charity on the recipient has long been known. (…) Give a man a fish and he will eat for a day: teach him how to fish and he will eat for the rest of his days.
(Hardin 1974:565)

A development project will always be a trust relationship between the giver and the receiver, as they both share interest in the relationship, and the outcome of the relationship depends on them both. If nothing is demanded of the receivers, the need for implementing agencies to follow up with more resources increases. It can also be the other way around. If receivers are not given any instructions, information or training on

a specific development project that they are given, it is unlikely that it will work as intended.

There are two factors in particular that appear to have influenced WBREDA' projects. First, it is not the people using, operating and monitoring use that has judicial and financial responsibility for the mini-grids, but WBREDA. This has decreased the need for users, customer committees and panchayats to take responsibility for the mini-grids. Second, it is difficult for those using, operating and monitoring to influence the organization of the system. For instance, many customers called for raising the penalty fee, but did not have real power to change it. As the customer committee members are not elected by the customers, they are not directly accountable to the customers. With lack of abilities to partake in decisions on how to organize the supply system in a way that is tailored to their needs, the customers have only one way to show their discontent: non-compliance.

When the technical capacity was good, these types of institutional problems did not arise. The Bushlight project emphasizes the importance of ensuring technical performance in this respect. The Urja Bandhus, for instance, have been important in allowing villagers to trust the other customers' actions, and efficient performance of both Urja Bandhus and the mini-grid is essential for keeping the customers' satisfied. But also other aspects, like providing knowledge and an overview of the situation for all, have ensured a general satisfaction and lack of suspicion towards others. With financial budgets decided on at general meetings and savings deposited in the bank, the degree of suspicion of others reaping benefits from the system is small. Seen together, these aspects make the customer perceive the system as fair.

8.2 Linking the past with the future

The experiences from the Sunderbans also suggest that it is important to acknowledge that the system can change over time. The organizational design at the Western side of the Sunderbans was highlighted as successful because of high customer compliance, but the organizational system did not prevent them from ceasing to comply eventually.

It is not easy for development project planners to predict how a project will affect its beneficiaries, or to predict how the context it is embedded in will change. In an increasingly interdependent world, the difficulty of predicting social change increases.

That new communication technology would grow to be so important was impossible to foresee for those planning the mini-grids. Needs are mutable, and changes with, for example, in abilities to pay, "neighbor effects,", routinized practices, new developments and so forth, made needs hard to plan for. They still need to be addressed, however, as they are an important part of common resource management. While Hardin worried over pressure such as population growth, and Ostrom mentioned technological change, change in regime type or unforeseen events, we now realize that pressure from consumption should also be addressed. Hardin's focus was on numbers. The number of people slicing up the world's cake is important, but the size of the slices cut up is as significant as the number of people sharing it.

At Satjelia, we saw that the discussion on future consumption is related to matters of justice. The customers have to decide on whether to increase future consumption for those who already own the supply system, or share it with other customers. The decision will be based on distribution of rights in the past (the customers were given free installation of distribution lines), the present (more customers want to connect) and the future (supply from the plant must be kept sustainable). This gives the question of justice an important role in common resource management. It is based on principles decided on in the present, but rooted in the past and oriented towards the future. The issue of justice has both increased in importance and controversy. Forty-four years after Hardin, the world has become increasingly globalized and interdependent, and boundaries between in-groups and out-groups, nations, citizenship and cultures are steadily blurring. Contemporary society raises new issues of common resource management and with that, new areas for common resource literature to attend to.

When new needs are created, and adapted into lifestyles, they are resistant to change. It is hard for the customers to adapt to the decline in supply and turn non-compliance to compliance. Two things in particular, stop them: one, the memory that others cannot be trusted to cooperate is still fresh in their minds. Second, if they start to adapt to the very limited supply from the grid, they would also have to change their lifestyles. The customers have grown accustomed to five hours of supply, being able to supplement their income, going out at night to see others without being afraid and saving time while cooking. How would Western people respond to abandoning all those things that facilitate their lifestyles – refrigerators, reading lights, computers, mobile

phones, washing machines and so forth? To adapt to the steadily decreasing hours of supply is challenging, especially when the customers at the same time are dreaming about what electricity can do.

8.3 Contextual variables

The cases have been analyzed as micro-level situations, but these may have been affected by other contextual factors. Characteristics like the trust climate in the nation or characteristics of a local context are likely to also have created variations in the Sunderban cases. For instance, we have seen that societies of equality are found to be trusting societies (Delhey and Newton 2005:323), and the mix of cultural, political and religious variation in India may have influenced levels of trust. Also, access to financial resources and knowledge can influence willingness to trust – a point that is important to acknowledge, as large parts of the country's population still live in poverty. The general corruption climate of nations can also have an effect, and in the last decades, all levels of politics in India have seen arrogance, corruption and violence prevail. It is believed that allocation of resources in India has been based largely on political considerations rather than recognition over sound technical and developmental criteria. Coupled with populist politics based on cleavages, this has produced widespread graft and corruption (Ganguly and DeVotta 2003:73-77).

Problems at the national level can trickle down to the local level, but influence different contexts in various ways. The context of the Sunderbans might be more conducive to trust than elsewhere. Caste and religious issues are not as intense as other regions in India, and socio-economic characteristics are fairly equally distributed among inhabitants. In addition, village characteristics can have played a part. WBREDA required villages to be motivated and show willingness to contribute. Some villages were not interested, and only wanted solar home systems (Ulsrud et al. in progress). WWF also emphasized motivation on the village level when deciding on a village for the Bushlight project. Originally, they planned to install the mini-grid on another island, but this village did not show the required interest in the project. Rajat and Jubilee, on the other hand, showed significant interest in the project (WWF). If the solar mini-grids projects that have been studied here had been installed elsewhere, such as in other

villages, other parts of India or in other countries, the trust relationships discussed in these cases would probably have played out in a different way.

8.4 Future prospects for the cases

WBREDA is hoping that the transfer of ownership to the panchayats will improve the current situation on Sagar and Moushuni. WBREDA, the committee members, operators and customers all believe that the panchayats will be able to enforce more control. One of the current problems appears to be that those who use, access and monitor the use of the supply system are not responsible for it, neither in judicial nor financial terms. The transfer of ownership to panchayats may address the lack of responsibility.

So far, the experiences on Satjelia warrant optimism. The model gives the villagers oversight of the situation, while the organization is characterized by a clear division of responsibility and a long-term horizon, with the potential to adapt to changes. If the Board of Directors' members ever start to take advantage of their positions, the customers can overthrow them. If cyclones should hit the island and destroy the mini-grid, they know their insurance will provide them with new parts. The operator will not grow dissatisfied with his salary, because he knows it is based on a careful consideration of a tight budget. If new needs shall arise, either financial needs or needs for some to increase consumption, they can think creatively in adapting the system to these needs or finding new income.

However, despite the system being resistant to change, there are pitfalls here. When WWF says that the potential problems that can arise are related to "the capacity of the Board of Directors and the performance of energy managers" (WWF), they point to something important: the future prospects, of both the WBREDA cases and the Bushlight project, will depend on a combination of technical and social processes which we cannot fully have control over. If failures in the technology arise –whether it is due to physical forces outside of their control or social processes – people are likely to find a scapegoat to hold accountable. Customer representatives are likely to face pressure from customers. If the technical performance is good, the situation will be easier to handle. But whether or not technological quality is good, the future development on Sagar, Moushuni and Satjelia will depend on the capacities of the customers' "pathfinders, their leaders" (as Bhavika labeled their job) to make the customers understand the rules for

electrical consumption to ensure their willingness to comply. If the customers do not understand why the fees, rules and division of responsibilities of the supply chain is shaped the way are, the likelihood of them putting pressure on their leaders will increase. And these "leaders" are, after all, only accountable to the people. If the people put pressure on the leaders to increase supply – out of a lack of awareness or lacking the will to maintain long-term horizons, then the technological performance of the mini-grids will decline over the long run.

8.5 The limits of trust

That brings us to what will be called "the limits of trust." By speculating on future prospects, the more normative question of common resource literature arises – how can we keep them from not being depleted in the future? To do that, we need to ensure that people coordinate their actions in a way that does not compromise the viability of the resource in the long run. There are several ways to coordinate action, ranging from strong enforcement of centralized control to facilitating voluntary collective action. No matter how strong the degree of enforcement, the social coordination will always contain a degree of trust. Trust is a precondition for control, and will always be needed because there will always be a need to control the controllers (Grimen 2009:85-89). We need to trust the controllers, which can explain why Bo Rothstein emphasizes the importance of leaders giving off trustworthy signals, and by saying that "trust comes from above, and is destroyed from above" (Rothstein 2005:199).

Bo Rothstein believed that an important way to create trustful societies with high degrees of social capital is through designing impartial and universal political institutions (Rothstein 2005:204-205). While the findings of this thesis support this, one can question whether trust and social capital is enough in the case of common resource management. It might be enough to ensure the primary focus of this thesis – how to make people comply and facilitate stable cooperation over time. However, in terms of social actions and their effect on resources, it is not certain that trustful cooperation between people is enough.

The limits of trust relates to two matters. The first is awareness. As laymen, we often know little about the processes of the physical world, and even less about how the consequences of our actions will affect the physical world. In addition, the distribution of

this knowledge is also critical, as the findings of this thesis suggest. The issue remains unexplored, but the gendered unevenness in distribution of information throughout the supply system can be problematic, as it is those who use the electricity most in the households – women and children – who seem to have the least knowledge of the system in general. If users of a resource do not have enough knowledge on the relationship between their use and the state of the resource, they will be prone to hold their leaders accountable on the wrong matters.

The second is the limits of the solution Rothstein gives to ensure social trust; namely, impartial and universal institutions. Their limits lie in that they are only accountable to people. This implies that if no one holds judicial responsibility for the resource in question, whether it is a natural or a manmade resource, there is no one to speak for and be responsible for the resource. What Elinor Ostrom and Bo Rothstein do in their theories is to emphasize the importance of bringing the interests of all concerned parties to the table, to facilitate stable social coordination over time.

However, as the physical world does not have agency, there is no one bringing it to the table. With the growing need for resources, and pressure from multiple appropriators to use it, resources will remain in danger of being depleted. This is what Hardin attempted to address in his tragedy. However, he was addressing only one part of the puzzle. Rather than believing that the type of property regime will determine the outcome, it is ensuring responsibility for use of the resource, regulating access, and distributing and managing the resource in an efficient manner that is most important. Someone needs to speak for the resource, and trustful cooperation is limited in this respect.

9 Conclusion

> We are common people. We don't want any luxury, we just want to manage.
>
> Chandresh

The quote from Chandresh illustrates the need for the Sunderbani customers to solve their commons dilemma. It is not candy bars they need to cooperate over, but basic needs. Life on Sunderbans is a life where proper sanitation is lacking, infrastructure is characterized by largely devastated brick roads, and the constant threat of cyclones and flooding looms over the people.

Access to electricity has improved the villagers' situation by diversifying their income, enabling their children to study at night, and making it safer to move around after dark. Electricity is seen as the key to slowly improving their living conditions, which makes their proper care of it even more important. In some of the Sunderban cases, people are complying with the rules for using electricity, in others they are not. To explain the variations between these cases, a comparison has been done between contexts over time.

9.1 Research questions revisited

9.1.1 Theoretical framework

The cases were identified as cases of common resource management, and three research questions were posed. The path to find an answer started in common resource literature, but the discussion showed that the literature of common resource management was incapable of accounting for the variations in cases.

The cases were not comparable in terms of access and property regime, as the cases of the Western side were based on state ownership, local management and lack of technical devices to control consumption, while the case on the Eastern side was based on communal ownership, with technical control devices ensuring separation of access.

In addition, the Eastern case was recently installed, and therefore not possible to analyze over time.

To link the characteristics of individual behavior, institutional design and social and technological change, the concept of trust has been employed, supplemented by theories on socio-technical systems. The notion of trust has been employed both in the sense of trust in persons, in institutions and in technology. Together with the data from the field, these three sets of theoretical perspectives – theories of common resources, trust and socio-technical systems – have aided us in answering the three research questions.

9.1.2 Findings

Employing trust as the conceptual framework has enabled us to trace several factors to explain the variations in compliance. Customers' reasons for complying have varied because of the capacity of technology, institutional set-up, knowledge about others´ actions, knowledge about the consequence of use on technology, general desires and hopes for life, previous experiences with others, and expectations held to the various elements in the chain: basically, other customers, operators, monitors and the technology.

On the Western side of the Sunderbans, on the islands of Sagar and Moushuni, customers have stopped paying because they do not want to pay when they are not getting the service to which they see themselves as entitled. Non-compliance has become widespread because of a combination of declining technical performance, impartial institutions, and lack of institutional resources. Social and economic development over the past decade has increased the customers' needs and desire to use electricity, adding further pressure to the system.

There have been many possible causes for the decline in supply, and the many potential scapegoats have made non-compliance a more legitimate response. In some cases, lack of awareness of the effect of overuse or politicians' framing of the situation is also likely to have obscured the cause-effect relation between overuse and supply. Lack of awareness, new needs, and the way that electricity has embedded itself in the lifestyles of customers have each in their own way made it hard to return to compliance.

On the Eastern side of the Sunderbans, on the island of Satjelia, compliance has been ensured because of technical control devices, and an institutional set-up allowing for clear division of responsibility and provision of information and training. Customers have not been overusing electricity because there has been little cheating – a result of the existence of technical devices like energy managers, junction boxes and armed wires on distribution lines. Customers have paid electricity fees because the technical performance of the mini-grids has been satisfactory, and because the system is perceived as fair.

The experiences from Satjelia, Sagar and Moushuni suggest the same: that variations in compliance are a result of a combination of the technical performance of the mini-grids, perception of the system as fair, and that institutional safeguards are in place to assure customers that their fellow customers, monitoring agents and other who are responsible, behave as they are expected.

9.2 Resonance in theories

Garrett Hardin assumed that self-interest and the type of property regime of the commons would explain the failure of common resource management. The cases on the Western side of the Sunderbans have proved Hardin wrong on two accounts.
First, the apparent "tragedy" of the decline of the solar mini-grids could not be explained by communal judicial ownership. Instead, one of the reasons for the path towards *de facto* open access of the resource was state ownership of the plants, coupled with lacking abilities to follow up.

Second, the decline of technology was not *only* found to be due to individuals' self-interest causing strain to the mini-grids, but also various contextual variables affecting the faith that customers had in others to comply. These reasons were based on a combination of control mechanisms that ensured trust in others. Such control has in these cases rested on social control, like norms, technical control devices, like the Urja Bandhus, and monitors like Beneficiary Committee Members, money collectors and linemen to physically disconnect customers.

Elinor Ostrom has suggested that a combination of factors affect whether common resource management is likely to succeed or fail. She has suggested that factors like cognitive limitations, perception of risk, the degree of social interaction, and norms

and interaction among contextual variables are likely to affect resource management. The thesis has found all these factors to be important in the Sunderban cases.
Ostrom has also postulated that well-defined boundaries, existence of arenas for conflict resolution, and allowing internal policy making over time are likely to characterize cases that will prove successful over time. The thesis supports the Ostrom theories, as the lack of ability to participate in decisions and change the rules of the supply system, such as raising the penalty fee for overuse, has been one of the factors that has allowed non-compliance to arise at Sagar and Moushuni. In the case of Satjelia, where the system is currently functioning very well, these elements are seen as some of the greatest strengths within the system, which is expected to make the system robust for change over time.

Trust is not the *solution* to these cases, but it has been employed as a useful conceptual framework to understand the variations in compliance between contexts over time. Even though we shall not conclude with a blind "trust in trust," the concept of trust should be acknowledged as important, as most forms of control – of others actions or over access to resources – are prone to fail if people do not have trust in them. The Chinese philosopher Confucius (551-479 BC) illustrates the relation between trust and control quite well, by noting that three things are necessary to rule a state – food, arms and trust. If a ruler has to give up any of these, he should first abandon food, and then arms. But the trust should be guarded to the very end, because without trust, everything will fall apart (Grimen 2009:11).

9.3 Future research on the commons

The thesis started with a quote by Beryl L. Crowe, who worried about natural and social science's tendency to relegate responsibility for problems to each other. Crowe's words should be kept in mind when approaching this field. When cause-effects are obscure, not only the people studied but the scholars studying them can become confused. There are at least three reasons why it is challenging to provide an exhaustive explanation of the Sunderban cases, and common resource situations in general.

First, the field is of an inter-disciplinary nature, challenging the ability to provide a full explanation, as scholars within different disciplines have tended to focus on different parts of the phenomenon. Second, the many possible causes for our

phenomenon create pitfalls. Garrett Hardin was "scientifically trapped" when he generalized from a non-representative case. His eagerness to generalize without proper scientific evidence might shed light on the third reason: descriptive and normative questions blend together in the literature, and are frequently hard to separate. Scholars pose questions like "how can we sustain our common resources?", or "how can we solve social traps?" The problem is not posing normative questions in itself, but the danger that the proposed solutions may create new problems. For instance, Garrett Hardin´s solution of centralized control would have lead to new problems in the Sunderban case, as the difficulties partly were due to lack of resources by the state agency.

Hardin dreamt of other possibilities to manage resources than "private property plus inheritance". He regarded this type of legal system as unjust, because "an idiot can inherit millions, and a trust fund can keep his estate intact" (Hardin 1968:1247). Yet he preferred it to the commons, because, as he added, "the alternative of the commons is too horrifying to contemplate". The Sunderban cases are part of a growing list that show that the world is more complex than Hardin suggested, and creates an opening for other solutions to be considered. Research has taken us far in the past decades, yet significant work remains.

Elinor Ostrom has suggested that trust and tracing dynamics of change need to be explored further, and the findings of this thesis suggest this to be a good lead to improve our understandings of the commons. Approaching the commons through the concept of trust is only one way to approach this subject, but it enables us to link micro and macro structures, and introduces an approach that can trace development over time. Through this approach, we can gain more knowledge of the commons and further build on the extensive body of work that Elinor Ostrom pioneered when initiating a new theoretical framework of the commons.

In memory of Elinor Ostrom
(August 7th 1933 – June 12th 2012)

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Antall ord i oppgaven: 38 556

Alle kilder som er brukt i denne oppgaven er oppgitt.

Appendix 1

List of informants with interview codes/ fictitious names

Bimal: Member of Electrification Cooperative (Sagar)

Bhavik: BC-member (Sagar)

Brinjesh: BC-member (Sagar)

Bhumit: BC-member (Moushuni)

Basant: Two members of BC (Moushuni)

Bhavika: Customer member in Board of Directors (Satjelia)

Bhavesh: Secretary and observer (Satjelia)

Contractor: Contractor

Chitesh: Customer (Sagar)

Charu: Shopkeeper (Sagar)

Chandrika: Customer (Sagar)

Chakor: Customer (Sagar)

Chandraban: Customer (Sagar)

Chandresh: Customer (Moushuni)

Chirayu: Customer (Moushuni)

Chetan: Customer (Moushuni)

Chahel: Shopkeeper (Moushuni)

Chetana: Customer (Moushuni)

Cavin: Customer (Satjelia)

Chinmay: Customer (Satjelia)

Chinkoo: Customer (Satjelia)

Chaitesh: Customer (Satjelia)

Chakshu: Customer (Satjelia)

Chudamani: Shopkeeper (Satjelia)

Ojas: Line man, Kamalpur (Sagar)

Osman: Operator (Sagar)

Omesh: Operator (Sagar)

Ojayit: Operator (Sagar)

Ovijan: Operator (Moushuni)

Oorjit: Operator (Moushuni)

Omja: Operator (Satjelia)

Waahid/ WBREDA1: WREDA official 1 (two interviews)

Wasan/ WBREDA2: WBREDA official 2

WWF: WWF

Appendix 2

Interview guides

Every interview starts with information about the project and myself, informs the participant about his or her rights and obtains the necessary consent to do the interview (see below). Each interview contains a short introduction on the topic of the interview. The introduction differs based on the different roles of the informant. The interviews are divided into different subsections of questions, but do not necessarily follow the same structure as proposed here.

Questions put in brackets are notes to the researcher – topics to potentially inquire about if not mentioned by the informant.

LIST OF INTERVIEW GUIDES

1. INTERVIEWS WITH CUSTOMERS AT SAGAR AND MOUSHUNI
2. INTERVIEWS WITH CUSTOMERS AT SATJELIA
3. INTERVIEWS WITH OPERATORS OF THE POWER PLANTS AT SAGAR AND MOUSHUNI
4. INTERVIEW WITH OPERATOR OF THE POWER PLANTS AT SATJELIA
5. INTERVIEWS WITH MEMBERS OF BENEFICIARY COMMITTEES AND ELECTRIFICATION COMMITTEE
6. INTERVIEWS WITH MEMBERS OF THE BOARD OF DIRECTORS
7. INTERVIEW, WBREDA1 (1st INTERVIEW)
8. INTERVIEW, WBREDA1 (2nd INTERVIEW)
9. INTERVIEW, WBREDA2
10. INTERVIEW WITH CONTRACTOR

INFORMATION ABOUT THE PROJECT AND RIGHTS OF THE PARTICIPANTS
(Information was given orally to the participant before the interview.)

I am part of a project studying the solar power plants in your village. Your village was visited earlier by other researchers who have studied the electrification of your village. The purpose of my stay here, and the interview with you, is to build on the earlier knowledge, and to study the changes in the organization of the solar technology that has recently taken place in your village. The reason why I am doing this is to try to find ways to make the system work better for you, and hopefully help other villagers who want to get access to electricity, particularly solar technology, in their village.

I will use a tape recorder while we are doing this interview, as well as taking notes. I am going to ask you questions about your name, age, occupation and others related to your status as a customer of the electricity system. The information will be used for my research project. Information about your name and who you are will be anonymized in the research project. As a researcher I have a duty to protect your privacy. This means that I will treat everything you say with great confidentiality. Your participation in this interview is voluntary, and you can at any time withdraw from participating in the study.
Is anything unclear about the project or your participation in it?
Do you give your consent to be interviewed?

1. INTERVIEWS WITH CUSTOMERS AT SAGAR AND MOUSHUNI

Introduction

There have been a lot of people coming here to study the solar power plants in your village and your use of the electricity from the plant as consumers. I will try not to focus on topics you already have been asked about, but I am interested in talking about the problems you experienced with the plants last year and if anything has changed after this. I will start by asking some general questions about you, and we can then talk about the power plant and the use of electricity in your life. Does this sound alright to you?

PART 1: ELECTRICITY, POWER AND ORGANIZATION

- Can you tell me a little about yourself (age, occupation, family etc.)?
- What were your expectations when WBREDA came to provide electricity?
- For how long have you had access to electricity?
- Are you satisfied with the delivery of electricity you have today? (If no: Why not?)
- In what ways do you think that increased access to electricity would have improved your life?
- Are you willing to pay more for electricity today than you would before you got access to electricity?
- In what ways are you using the electricity today (appliances, purposes etc.)?
- What would you like to use electricity for if you had access to more electricity?
- Do you know why there are "use limitation" rules for the electricity from the power plant?
- What will happen if you use more electricity than you are allowed to? (To you? And will there be any consequences for the power plant?)
- Is it difficult to follow the rules?
- Does everyone in the village comply?
- What kind of information have you received about the solar technology project?
- Who can you turn to if you have any questions regarding electricity consumption?

PART 2: THE ELECTRICITY CONTRACT

- Can you tell me why WBREDA chose to close the power plant for a period of time?
- What happened after this?
- What was it like to be without access to electricity for a period of time?
- How are the members of the Beneficiary Committees selected?
- Do you feel it is important or not important to comply with the rules? Why or why not?
- What happens if you don't comply? (Sanctions?)
- Does everyone in the village comply?
- Are there equal sanctions for everyone?
- Do you trust WBREDA to manage things in an appropriate manner?
- Do you trust the operator and the local management (local committee/ Gram panchayat/ Cooperative) to manage the power supply and the revenue in an appropriate manner?

PART 3: LIFE AND FUTURE

- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

2. INTERVIEWS WITH CUSTOMERS AT SATJELIA

Introduction

You are a customer of the power plant that started operation in the village in February, and I would like to talk a little bit about this. I will start by asking some general questions about you, and we can then talk about the power plant and the use of electricity in your life. Does this sound alright to you?

PART 1: ELECTRICITY, POWER AND ORGANIZATION

- Can you tell me a little about yourself (age, occupation, family etc.)?
- What were your expectations when the power plant was set up to give you electricity?
- I have heard that a lot of people were sceptical when they first heard about this project. Why did you want to sign up to get electricity?
- In what ways are you using the electricity today (appliances, purposes etc.)?
- Are you satisfied with the supply – does it fulfill your needs?
- I have heard that some people sell some of their electricity to others. Do you use all your electricity or do you sometimes sell it to others?
- How much electricity do you have?
- What do you pay for that and how did you decide on the price?
- Do you feel that the cooperative is a good way to manage the system?
- You undertook some training about energy services, household energy planning and budgeting before you received electricity. What did you think about this training?

PART 2: THE ELECTRICITY CONTRACT

- What do you think about the Urja Bandhu? Is it easy to operate?
- Some of the other islands with solar power plants in Sunderban have experienced some problems with electricity theft. Is it possible to cheat on the system you are using?
- What will happen if you try to cheat the system (any penalties)?
- Who can you turn to if you have any problems with your electricity consumption?

- How is the Board of Directors selected?
- How does the Cooperative decide on issues?
- Do you feel you have enough information about the way the system works?

PART 3: LIFE AND FUTURE

- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

3. INTERVIEWS WITH OPERATORS OF THE POWER PLANTS AT SAGAR AND MOUSHUNI

Introduction

As an operator, you are a key person in the management of the system, and you have to make decisions regarding the functioning of the power plant. If I understand it correctly, these decisions can be challenging to make sometimes, and there are challenges related to the technical aspects of the plant. Is this a correct interpretation? I want to talk a little bit about the problems you have experienced with the power plant, and the changes made by WBREDA after this.

PART 1: WORKING AS AN OPERATOR

- Can you tell me a little bit about yourself (Age, where you come from, family, how long have you worked at the plant, what kind of work did you do before, technical training, etc)?
- How do you feel about your job? (Do you like it, what parts of it do you like or not like?)
- What were your expectations about the job before you started working? Were they fulfilled?
- Have you gotten any information from WBREDA about new developments and happenings?
- How much are you involved in the life in the village?
- Do you feel that it is important for you to get along with the others in the village?
- What are the pros and cons with your job? (For example advantages to having continual access to electricity in the power plant?)
- What is your salary (and are you satisfied with it)?

PART 2: THE EMPLOYMENT RELATIONSHIP

- Is there any way you think your employment relationship could have been organized differently?
- Can you tell me a bit about the training you have gotten for the job? (Information? Follow-up?)

- Is it easy or difficult to maintain the power plant?
- Who do you call if something is wrong?
- How often do you have contact with the contractor? How often does he come to Sunderban?
- Have you reflected on the difference between you and the other inhabitants in the village regarding access to electricity?
- How do you prevent batteries from degrading in the monsoon season?
- What happens with the power plant during the flooding?

PART 3: LIFE AND FUTURE

- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

4. INTERVIEW WITH OPERATOR OF THE POWER PLANTS AT SATJELIA

Introduction

As an operator, you are a key person in the management of the system, and you have to make decisions regarding the functioning of the power plant. I will start by asking some general questions about you, and we can then talk about the power plant, your role as an operator, and the use of electricity in your life. Does this sound alright to you?

PART 1: WORKING AS AN OPERATOR

- Can you tell me a little bit about yourself (Age, where you come from, family, how long have you worked at the plant, what kind of work did you do before, technical training, etc)?
- Do you live at the power plant?
- What are your responsibilities as an operator?
- How do you feel about your job? (Do you like it, what parts of it do you like or not like?)
- What is your salary (and are you satisfied with it)?
- Do you do any other kind of work in addition to being an operator?
- What do you do if you receive any complaints from the customers?
- What kind of complaints do you receive?
- Some of the other islands with solar power plants in Sunderban have experienced some problems with electricity theft. Is it possible to cheat on the system you are using?

PART 2: LIFE AND FUTURE

- In what ways have your life and the life of the other villagers changed since electricity came to the village?
- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

5. INTERVIEWS WITH MEMBERS OF BENEFICIARY COMMITTEES AND ELECTRIFICATION COMMITTEE

Introduction

As I understand it, the role of the BC is to decide on tariffs and try to assist customers to pay on time and not use more electricity than they are allowed. As a member of the BC, you are appointed by the Gram Panchayat (local government), and to be appointed it is a prerequisite that you are already a custumer. Is this a correct description?

PART 1: RESPONSIBILITIES AS A MEMBER

- Can you tell me a bit about yourself (age, occupation, family, etc.)?
- How long have you been a BC-member/ member of the electrification committee (and how often do you change members)?
- Can you tell me a little bit about your tasks as a member of the beneficiary committee/ member of the electrification committee?
- How were you appointed as a member of the committee?
- If I have understood it correctly, it has been a time- consuming task to monitor all customers and try to regulate the amount of electricity they are using. Is this a correct understanding?
- In what ways do you check up on consumers and how often do you do it?
- Have there been any changes after WBREDA closed the power plants?
  (If they mention the transfer of ownership: Can you tell me a little about what this change involves? What will be the benefits? What will be the challenges?
- What happens with the power plant during the monsoon?

PART 2: LIFE AND FUTURE

- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

6. INTERVIEWS WITH MEMBERS OF THE BOARD OF DIRECTORS

Introduction

I would like to ask you some questions about the power plant and your role as a member of the Board of Directors. I will start by asking some general questions about you, and we can then talk about the power plant, your role as a member of the Board and the use of electricity in your life. Does this sound alright to you?

PART 1: RESPONSIBILITIES AS A MEMBER

- Can you tell me a bit about yourself (age, occupation, family etc.)?
- When were you appointed as a member of the Board?
- How were you appointed?
- Why did you want to be a member of the Board?
- What are your tasks and responsibilities as a member?
- Are there any parts of the job that are challenging?
- In your view, what are the benefits with these types of power plants?
- Some of the other islands with solar power plants in Sunderban have experienced some problems with electricity theft. Is it possible to cheat on the system that the customers are using?
- Do you sometimes receive complaints (and if so, what do you do?)?
- How do you decide on tariffs?
- What happens with the power plant during the monsoon?
- Are there any plans for the plant in the future?
- In what ways will you say your life has changed since the power plants came?

PART 2: LIFE AND FUTURE

- What is important for you to lead a good life?
- What are your hopes and dreams for your children in the future?
- What is the role of electricity in this picture?

7. INTERVIEW, WBREDA1 (1st INTERVIEW)

Introduction

Last year members of the research team, "Solar Transitions," were here to study your work with the solar technology projects on the Sunderban Islands. Your projects have earlier been referred to as success stories, and your accomplishments with bringing electricity to the islands have been considered impressive. But I know that you have had to work a lot with both the organizational and technical solutions to make it work. Last year, when the Solar Transition team was here, the power plants and the system were not functioning optimally. You had experienced problems with overuse and non-payment for a while, but waited for a time before any actions were undertaken, because you were not sure what should be the appropriate measures to take. Is this correct? Then you finally decided that you would shut down some of the power plants for awhile, and you have now made some changes in the system. Correct? Since you already provided a lot of background information to the Solar Transition project, I want to focus mostly on the changes that have taken place since then. I want to start out with some short questions about closing of the power plants and talk about what has happened since.

PART ONE: BACKGROUND

- Could you start by telling me your name, age and profession (what is your role in the management of the power plants)?
- Can you tell me about why many of the power plants closed in 2010?
- (If overuse is mentioned: What were your reactions on the behavior of the customers? Did you use any other sanctions before closing the plants?)
- Have the power plants been re-opened?

PART TWO: TECHNICAL AND ORGANIZATIONAL CHANGES

- Have you made any changes in the ways you organize it since then?
  (If so, what are the reasons for making this kind of change?)
- Have there been any changes in the role of the Beneficiary Committees?
  (payment, selection of members?)

- Have there been any changes in the role of the operators? (Training, responsibility for training, salaries?)
- Have there been any changes in the role of the contractors? (Change of contractors, type of contract, training, responsibilities, relations to suppliers and operators?)
- Is there anything else you would have organized differently if you had the chance? (If so, why? And perhaps why is it not possible?)
- In what way have you taken social factors into consideration?
- What is the weakest technological part of the chain today?
- What is the weakest organizational part of the chain today?
- What are your most important challenges today/what are the most important challenges today in this kind of system?
- What kind of information did the customers get about the linkages between their use of power and the functioning of the power plants? (Now and before – any difference?)
- You have done a lot of pioneering work on these power plants, and have learned about many of the challenges in such projects underway in your work. What kind of recommendations would you like to make to someone planning projects like this in the future? Is there anything you've learned that you would liked to have known before you started to plan the project?
- Is it possible to plan for anticipated consumption growth in projects like these – for example within solar technology projects? (More flexibility in the system, enabling people to use electricity throughout the day?)
- What are your plans going forward now for the organizational and technical aspects of these power plants?
- What will happen when the national grid reaches Sagar Island?
- How are the other solar activities going? What are the main activities and what are the main challenges of these?

8. INTERVIEW, WBREDA1 (2nd INTERVIEW)

- You have done a lot of pioneering work with these power plants and learned a lot from the challenges undertaken in this project. What kind of *recommendations* would you like to make to someone planning projects like these in the future?
- You are now handing over the responsibility to the panchayats. What is the main reason for this change?
- What will be the responsibilities for the panchayats after this, and what responsibilities will still be with WBREDA?
- Are there any plans to install some kind of current meters in the future?
- Are you planning on feeding the grid with electricity from the power plants?
- In your opinion, what are the advantages and disadvantages with off-grid power plants compared to solar home systems?

9. INTERVIEW, WBREDA2

PART 1: THE TRANSFER OF OWNERSHIP

- What is the official title of your job and what kind of tasks do you do in your job? When will the transfer of ownership of the power plants take place?
- *Who* will own the plants? Same or different ownership model on Sagar/ Moshouni?
- What will be the responsibilities of the owners of the power plants?
- What responsibilities will WBREDA give away to the local authorities and what responsibilities will WBREDA retain for the plants?
- Will WBREDA pay for cost of maintenance, operating costs, etc. in the future?
- Are there any plans to raise the electricity fee for the customers or will it remain the same? Who will take decisions like this in the future – WBREDA or the local authorities?
- What will be the challenges now that the transfer of ownership has taken place?

PART 2: OVERUSE AND ORGANIZATIONAL ASPECTS

- Do you have any immediate plans or measures to implement to cope with the problem of over-use?
- If the battery degrades early due to over-use in the future. who will pay for replacing the battery?
- On what kind of criteria do you base your choice of contractors for the power plants?
- Do the contractors have any local representatives that can assist the operators or customers with technical problems on short notice?
- Are there any minimum salaries for operators?
- Do you think the operators should be paid more?
- Do you think the operators have sufficient technical education?
- Do you have any guidelines for membership in the Beneficiary Committees? (e.g. do both genders need to be represented; are you allowed to be part of a political

party when you are a BC-member,;are thereany guidelines they have to follow for the specific job they are going to do?)

PART 3: OTHER ASPECTS

- In your opinion: What are the advantages and disadvantages with off-grid power plants compared to individual solar home lightning systems?
- How is the expansion of the grid to Sagar doing? What will happen to the power plants on Sagar when the national grid reaches out to the villages?
- Which of the villages in Sagar and Moushuni have had new battery banks installed in the solar PV plants/mini-grid systems?
- How many of the customers in Sagar and Moushuni are currently paying for electricity?

10. INTERVIEW WITH CONTRACTOR

Introduction

As a company with high technical expertise, you have a contract with WBREDA on the operation and maintenance of the power plant in one or several of the islands at Sunderban. I want to talk a little bit about how the relationship you have with WBREDA and the operators are organized and your role as a contractor.

- Can you tell me a little bit about yourself (Name, age, any education, professional background, your role in the company, how long you have worked for the company)?
- Which plant(s) do you have a contract for and for how long have you had the contract?
- What kind of projects does your company do?
- Are there some projects that demand a lot of attention?
- What are your responsibilities as a contractor?
- How often do you visit the power plants at Sunderban?
- What is the situation at the power plant at the moment?
- Can you tell me a little bit about your relation to the operator? (Hiring of the operator, availability of trained personnel, communication, training, salary?)
- Can you tell me a little about your relation to WBREDA? (cooperation, possible problems?)
- Have there been any changes in the contract you have with WBREDA during your time as a contractor?
- Do you think the organization of the system is functioning well today, or is there anything that you would like to change? (If so, what?)

Appendix 3: Village characteristics

	Sagar			Moushuni		Satjelia
	Kamalpur	**Khasmahal**	**Natendrapur**	**Baliara**	**Bagdanga**	**Rajat Jubilee**
Mini-grid installed	1996	1999	2000	2003	2001	2011
Number of customers	71*	129*	89*	250**	250**	70
Daily electricity supply per customer	70W or 120W	70W or 120W	70W or 120W	70W or 120W	70W or 120W	Minimum 200W
Status of mini-grid, per August 2011	Waiting for battery replacement.	Batteries replaced in February / March 2011.	Batteries replaced in June 2011.	Batteries replaced in May 2011.	Batteries replaced in August 2011.	Well-functioning operation.
Payment (Y/N)	No	No	No	No	No	Yes
Overuse of el. (Y/N)	Yes	Yes	Yes	Yes	Yes	No

*Number of customers obtained by WBREDA 2009 (Ulsrud et al. in progress)

** Number of customers obtained by TERI 2009 (Ulsrud et al. in progress)